WEAPONS SYSTEMS ACQUISTION CURRICULUM

by

Maurice Elmer Halladay

United States
Naval Postgraduate School

THESIS

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Maurice Elmer Halladay

and

Joseph Walter Murray

December 1970

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Weapons Systems Acquisition Curriculum

by

Maurice Elmer Halladay
Commander, United States Navy
B.S., Tufts University, 1953

and

Joseph Walter Murray
Lieutenant Commander, United States Navy
B.A., Vanderbilt University, 1956

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ABSTRACT

A study was performed to develop the curriculum that would utilize six academic quarters in the most effective manner to produce a graduate who could function effectively within the existing Department of Defense acquisition system and who could simultaneously assess and improve the system. The method followed was to develop a project manager model, then test the elements of existing applicable academic courses and selected military acquisition curricula against the model attributes in a Course Evaluation Matrix. Elements shown to be valuable were integrated into a product oriented curriculum consisting of a central core of project management courses and a series of basic academic discipline courses. The project management core interacts with a series of inputs simulating the life cycle of a typical project. Academic discipline courses are sequenced to be of immediate application in producing required output documentation. An Appendix provides a highly detailed description of the recommended curriculum.

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I. INTRODUCTION

A. BACKGROUND

The steadily increasing cost and complexity of modern weapons systems has resulted in a requirement for a corresponding increase in sophistication of weapons systems acquisition techniques. The traditional line and staff organization has proved to be unresponsive to the needs for long-range planning, rapid and quantitative decision-making, detailed control, and continuing progress evaluation required in today's defense environment. The primary response to the requirement for new acquisition techniques has been project management. However, no technique can be a panacea to the acquisition problem. The project management organization without personnel knowledgeable in its application cannot produce the desired project objectives. In recognition of the need for skilled project managers, the Chief of Naval Operations has directed that a career development pattern for project managers be established.[1] The Chief of Naval Material was designated as subspecialty advisor for the project management career pattern and as part of this responsibility has sponsored the development of a curriculum leading to the Master of Science in Management with a weapons system acquisition specialty at the Naval Postgraduate School. The object of this program is to produce a graduate who has, (1), the capability of functioning effectively within the existing defense acquisition system, and, (2), the intellectual background to assess and improve the system.

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[1] Chief of Naval Operations Letter OP-1020/jd, Ser 13118P10, Dtd. 11 August 1970.

The object of this thesis is to develop the curriculum that will most effectively meet this dual objective.

B. CONSTRAINTS AND ASSUMPTIONS

1. Constraints

The following constraints apply to the recommended curriculum:

a. The course of study is limited to six academic quarters.

b. All students must possess an engineering baccalaureate degree with a pattern of above-average grades in mathematics through Differential and Integral Calculus.

c. The curriculum must meet the departmental requirements for a Master of Science in Management. These are:

(1) At least one graduate-level course in each of the following areas:

(a) Economics

(b) Probability and Statistics

(c) Financial Management

(d) Behavioral Sciences

(e) Management Theory

(f) Operations Research

(2) A minimum of 56 hours of graduate-level work with 16 hours at the 4000 level, or a minimum of 48 hours of graduate-level work with 8 hours at the 4000 level and a thesis.

(3) Sixteen (16) or more hours at the graduate level in the approved project management sequence.

2. Assumptions

The following assumptions were made by the authors:

a. The candidates selected would be thoroughly conversant with Differential and Integral Calculus.

b. Undergraduate preparation in business and management disciplines would be nil.

c. The candidates would range in rank from LTJG through LCDR.

d. Unrestricted use of Computer Science, Operations Research, and Management Science personnel, facilities, and course materials would be possible.

e. Candidates would not have practiced at the engineering profession for any significant period.

f. Undergraduate engineering curricula do not include extensive use of Applied Statistics.

C. IMPACT OF CONSTRAINTS AND ASSUMPTIONS

1. The limitation to six academic quarters together with the requirement to provide at least one graduate-level course in each of six areas forced a choice between broad survey courses covering an entire academic field and a more in-depth coverage of a segment of that field. Survey courses were determined to have a minimal value in furthering the aims of project manager development. Therefore, the latter option was selected in the fields of Economics, Financial Management, and Behavioral Sciences with the full knowledge that it will bias the students' outlook in these disciplines.

2. The requirement for an engineering background permitted the selection of more rigorous Probability and Statistics and Operations Analysis courses than is the case for the current Management program.

3. The Constraints are discussed further in Appendix B.

II. APPROACH

A. PROBLEMS DEFINED

The first step taken in the effort to design a Master of Science Curriculum for Weapons Systems Acquisition Managers was to break this objective into its key elements. These elements provided problems of more manageable proportions than that of the overall objective and allowed more efficient routing to this ultimate destination.[2] The problems in developing a curriculum for Weapons Systems Acquisition Managers were found in addressing the following questions:

1. What is the mission of a graduate education at the Master's level?

2. How will this education be used by the students after graduation?

3. What kind of individuals should enter the curriculum as students?

4. What kind of individuals should teach the courses included in the curriculum?[3]

5. What materials and procedures will work best to teach the elements of the chosen curriculum?

6. What standards will be employed to evaluate the performance of the students and the instructors?

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[2]Mager, R. F., Preparing Instructional Objectives, Palo Alto, California, Fearon Publishers, Inc., 1962.

[3]Churchman, C. W., "Operations Research As a Profession," Management Science-Application, Vol. 17, No. 2, October, 1970.

B. SEQUENCE OF THE STUDY

Definition of curriculum goals first required a definition of project management. Review of Chief of Naval Material and Navy Systems Command Directives and policy statements, research of the academic literature on this subject, and personal interviews indicated that there is no universal agreement on the scope and functions of a project manager. Three levels of project management relevant to the proposed Weapons Systems Acquisition Program were defined.

1. Research and Development management, most applicable to those officers anticipating duty with CNM and Systems Command projects in a formative stage.

2. Industrial Management, most applicable to those officers anticipating duty at shipyards, aircraft factories, or rework facilities.

3. Audit and Administrative management, applicable to both categories above, but with emphasis shifted to financial and legal aspects as opposed to technical and program considerations.

By utilizing this limited definition of scope of project management, it became possible to define the goals of the curriculum. Sections III and IV trace the development of these goals in detail.

The result of the goal definition process was an operational project manager model. The next step in the study was to utilize this model to evaluate the contribution to project manager development of current Naval Postgraduate School courses in Management, Computer Science, Operations Analysis, and Probability and Statistics. Additionally, elements from other programs, notably the Air Force Institute of Technology's ten-week course in project management, were evaluated. This resulted in a first determination of courses and course elements

potentially useful in constructing the curriculum. This process is described in detail in Section V.

The courses and elements that showed significant value were then assembled into a trial curriculum. The project manager model was utilized to check the trial curriculum for balance of emphasis among the desired project manager attributes and a series of iterations performed to eliminate gross inequities. Although no absolute criteria were developed to define an optimal balance among the attributes, the methodology employed clearly shows the balance that exists in any given curriculum and is readily available for use if a different weighting of attributes is preferred. The final result of this process is the recommended curriculum of Section VII.

Having constructed the outline of the curriculum, it became necessary to retrace the methodological steps to provide in precise and unambiguous terms the content of all proposed new courses, and, where applicable, to recommend changes in emphasis in existing courses. Appendix A is a compilation of these course specifications.

C. PROJECT MANAGEMENT CONCEPT APPLIED TO THE CURRICULUM

After detailing the problems involved in the development of such a curriculum, the potential methods of solution were considered. Basically, two methods were available:

1. An academic disciplines approach of collecting all known Management Science courses from various university curricula and deriving a consensus curriculum from them that would be workable within the six quarters allotted.

2. A product oriented systems approach that would consider the key problems and their interactions, independent of external constraints.

The systems approach appeared to offer the greater opportunity for success and challenge. Therefore, it was selected.

This approach envisions a central core of project management courses directed by a coordinating professor. The basic academic disciplines would feed into this core as required and appropriate, and the core would interact with an input-output event series that would encompass the life cycle of a typical project, telescoped into four academic quarters. In this concept the coordinating professor is analogous to a project manager, the academic discipline professors to line managers, and the input-output event series to program milestones. Three tools of Systems Analysis were employed in this undertaking. These tools and their employment were:

1. The process of problem identification and goal establishment through model building.

2. The process of curriculum design through the iterative use of the scientific method.

3. The process of course trade-off analysis through decision matrices.

III. THE GENERAL MANAGEMENT MODEL

A. GENERAL

Concern with the problem of selecting the most efficient route to a destination is futile unless the nature of the destination is known.[4] In order to determine those courses that should go into a project management curriculum, it was necessary to determine those attributes and abilities which a project manager should possess. Initially, the Chief of Naval Material's definition of the functions of a project manager was taken as the curriculum destination. These functions were condensed into the following list of items which a project manager should possess:

1. An ability to plan
2. An understanding of financial management
3. An understanding of Government procurement practice
4. An ability to conduct "Concept Formulation/Contract Definition" processes
5. An ability to provide technical management and direction
6. An understanding of integrated logistic support processes
7. An ability to conduct program evaluations
8. An ability to coordinate and communicate
9. An understanding of contract administration
10. An understanding of personnel administration[5]

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[4]Mager, R. F., op. cit., p. 5.

[5]NAVMATINST 5000.5 (Series), "Project Management in the NMSE."

When existing Naval Postgraduate School courses were graded by this listing, a reasonable spread of course content values resulted for individual courses and curriculum balance. However, this evaluation scheme proved to be too subjective to provide reliable comparative results when used by different evaluators. As the reliability feature was indispensable to a significant result, it was decided to construct a model that would definitize both the processes and disciplines of project management, thereby increasing objectivity and reliability. The closer the statement of objectives of the curriculum approaches measureable attributes observable in its graduates, the easier and more reliable is program evaluation and balancing. The course descriptions currently available to students at the Naval Postgraduate School, as well as data from many other graduate schools, left much to be desired in this respect. It seemed that much could be gained in terms of reducing redundancy and in improving faculty-student communication if these descriptions were presented as student terminal behavior objectives.[6]

To construct any model it is necessary to establish baseline criteria that will direct the effort of its designer to his goal and aid any subsequent user in understanding the model's possible applications and limitations. The baseline criteria selected for the general management model had to address the following questions:

1. What is the general purpose of management?
2. What are the general processes of management?
3. What are the sources of the general problems of management?

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[6]Mager, R. F., op. cit., p. 26.

4. What disciplines are common to management as it goes through its processes and faces its problems?

Management is the process concerned with the achievement of objectives. The general processes of management are planning, organizing, energizing, and supervising. The first step in constructing the Management Model is shown in Figure 1.

The most common causes of weak, poor, and unhealthy management have been determined to be the following:

1. Inability to make decisions.

2. Insufficient time and effort given to the coordination of activities.

3. Failure to consider, recognize, analyze, and solve major problems.

4. Fear of delegating authority and responsibility.

5. Poor vision, foresight, and imagination in determining short- and long-range plans and objectives.[7]

These elements are evidently the source of problems faced by management.

The next step in construction of the Management Model became more complex. In order to make the presentation clear, each management process was defined and developed separately:

B. THE PLANNING PROCESS

This process is primarily composed of the problem identification routine and the strategic decision routine. The problem identification routine consists of defining the differences between actual and desired conditions. This definition is founded on the assumption that most

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[7]Rose, T. G., The Management Audit, 3rd ed., London, GEE, 1961.

ORIGINAL MANAGEMENT MODEL

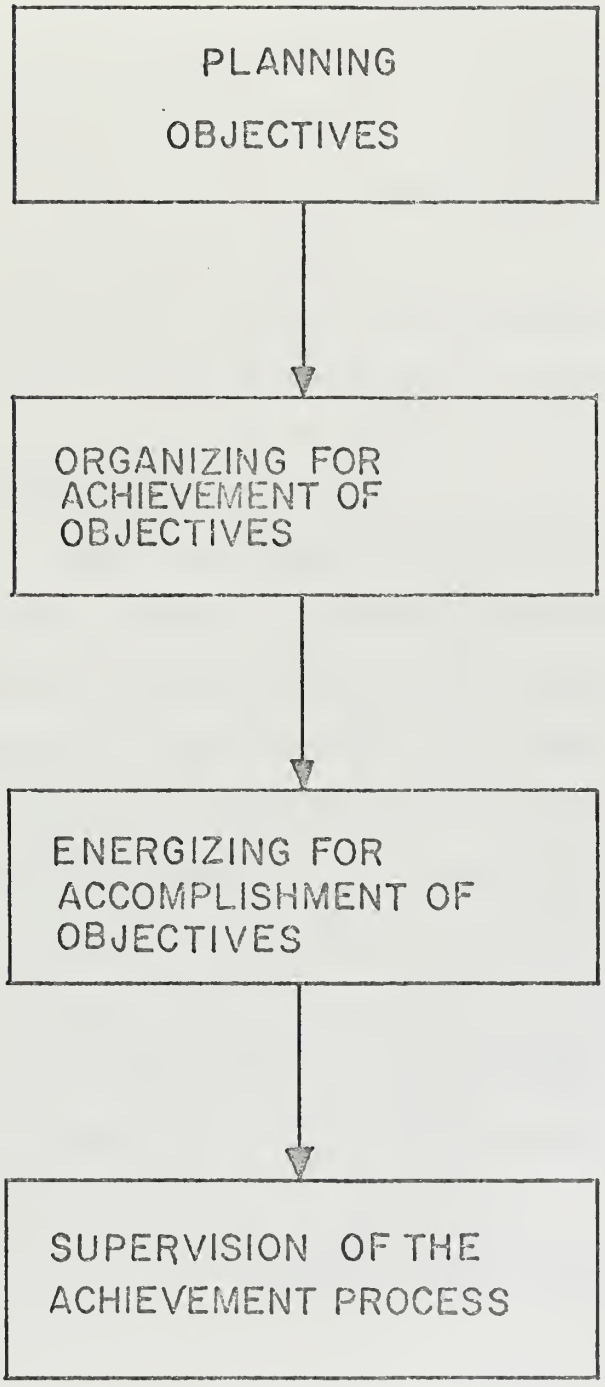

figure (1)

improvements come from correcting unsatisfactory situations, and, for the most part, unsatisfactory situations are defined by departures from historically established models of performance.[8] The strategic decision routine consists of the consideration of objectives that have been attained and are candidates for retention as well as the possible alternative courses of action that might lead to the elimination of known problems. The strategic decision routine is also involved in the allocation of available resources to these items by categorizing them in short- and long-range objectives plans.

In consideration of these elements, the "planning objectives" box of the model evolved into the configuration shown as Figure 2.

C. THE ORGANIZATIONAL PROCESS

This process is primarily composed of routines to structure the communications network necessary to coordinate human and non-human resources allocated to planned objectives. This communications network is diverse in content and broad in scope. It is made up of responsibility-authority relationships, data collection-feedback relationships, process control-coordination relationships, and function-evaluation relationships. It is essential during the organizational process that each of these relationships be balanced with full consideration of the contribution each should make to the achievement of planned objectives. Modern management, no matter how competent, cannot function to full effectiveness without a sound and current plan of organization.

The "Organizing for the Achievement of Objectives" box then evolved as displayed in Figure 3.

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[8]Pounds, W. F., "The Process of Problem Finding," Industrial Management Review, Vol. 11, No. 1, Fall, 1969.

FIRST ITERATION - PLANNING OBJECTIVES MODEL

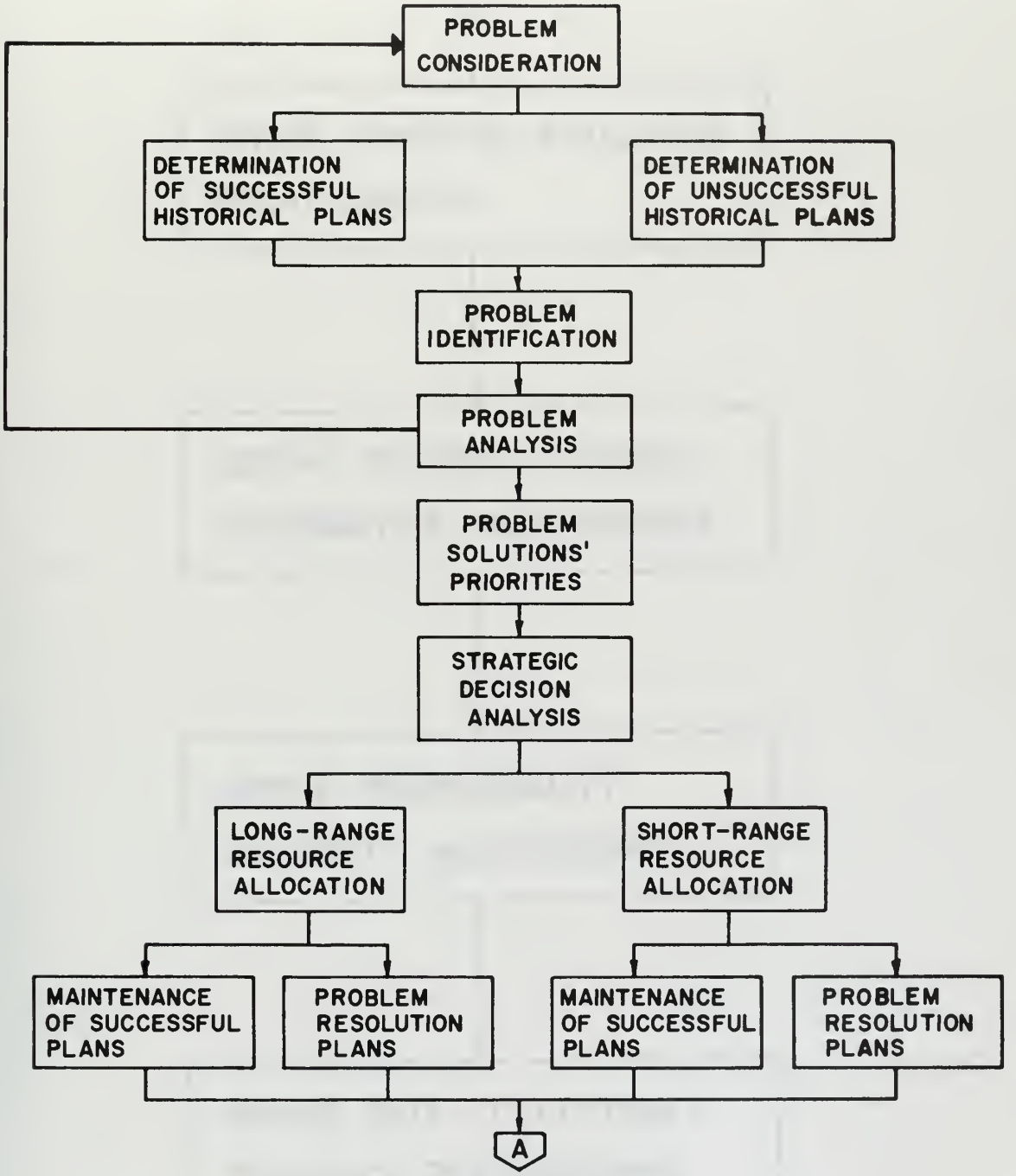
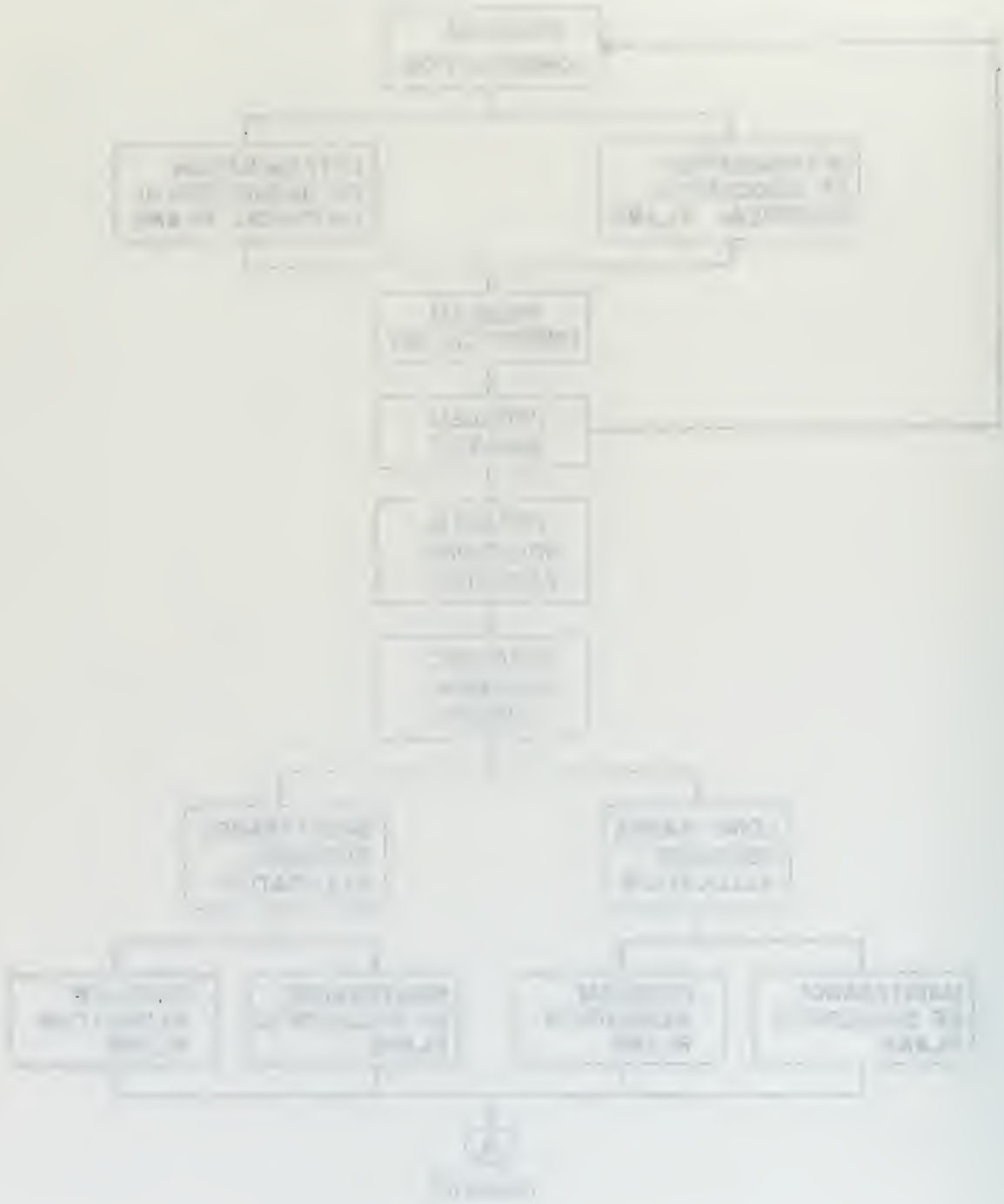


figure (2)



FIRST ITERATION - ORGANIZATIONAL PROCESS MODEL

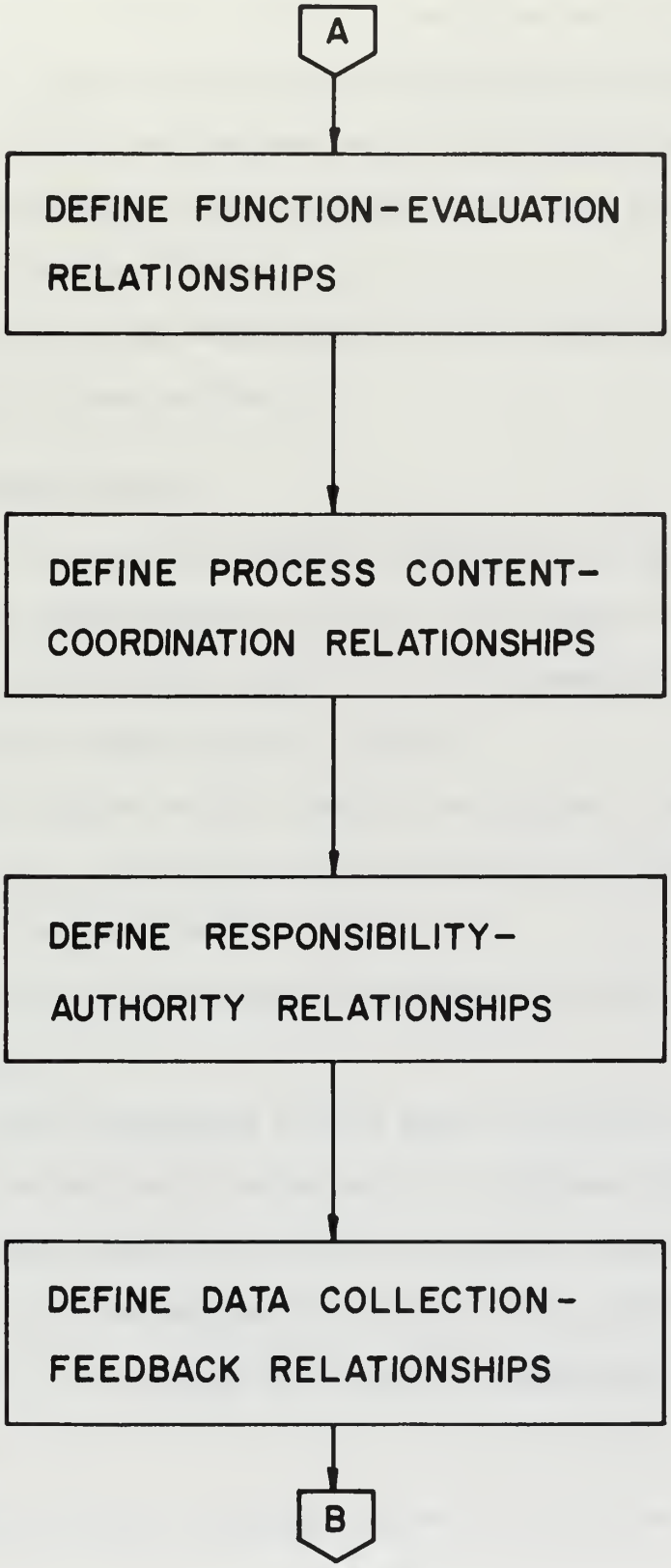


figure (3)

D. THE ENERGIZATION PROCESS

This process is primarily composed of the routine of decision promulgation. This routine involves the selection and activation of staff, release of capital funding, and implementation of the communications network. It is also concerned with obtaining and supplying non-human resources within the parameters of the legal structure defined during the Organizational Process.

The "Energizing of the Organization for the Accomplishment of Objectives" box is shown as Figure 4.

E. THE SUPERVISION PROCESS

This process is primarily composed of conflict resolution, evaluation, and training and administration routines. All of these routines are initiated through the sensory capability of the communications network. This relationship is demonstrated in Figure 5.

This process applies to both internal and external links of the organization, i.e., the suppliers of resources, the customer, and the elements of the organization.[9]

The "Supervision of the Objective Achievement Process" box is displayed in Figure 6.

Once the general management process model was complete, it was necessary to note that each routine was of a continuous nature. Each part was constantly undergoing implicit or explicit change of one degree or another. It also became possible to identify a general management discipline model. This evolution allowed the comparison of traditional

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[9]Black, Max, Critical Thinking, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1952.

FIRST ITERATION-ENERGIZATION PROCESS MODEL

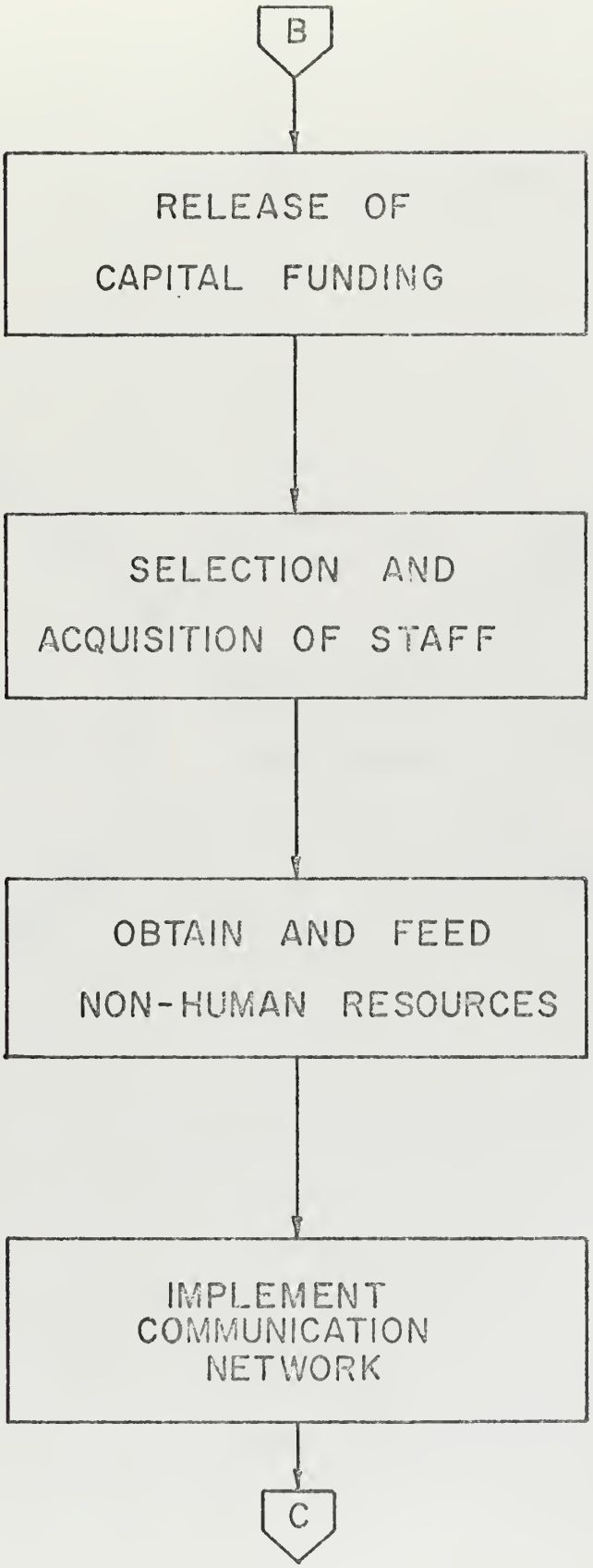

figure (4)

SENSORY NATURE OF COMMUNICATIONS NETWORK

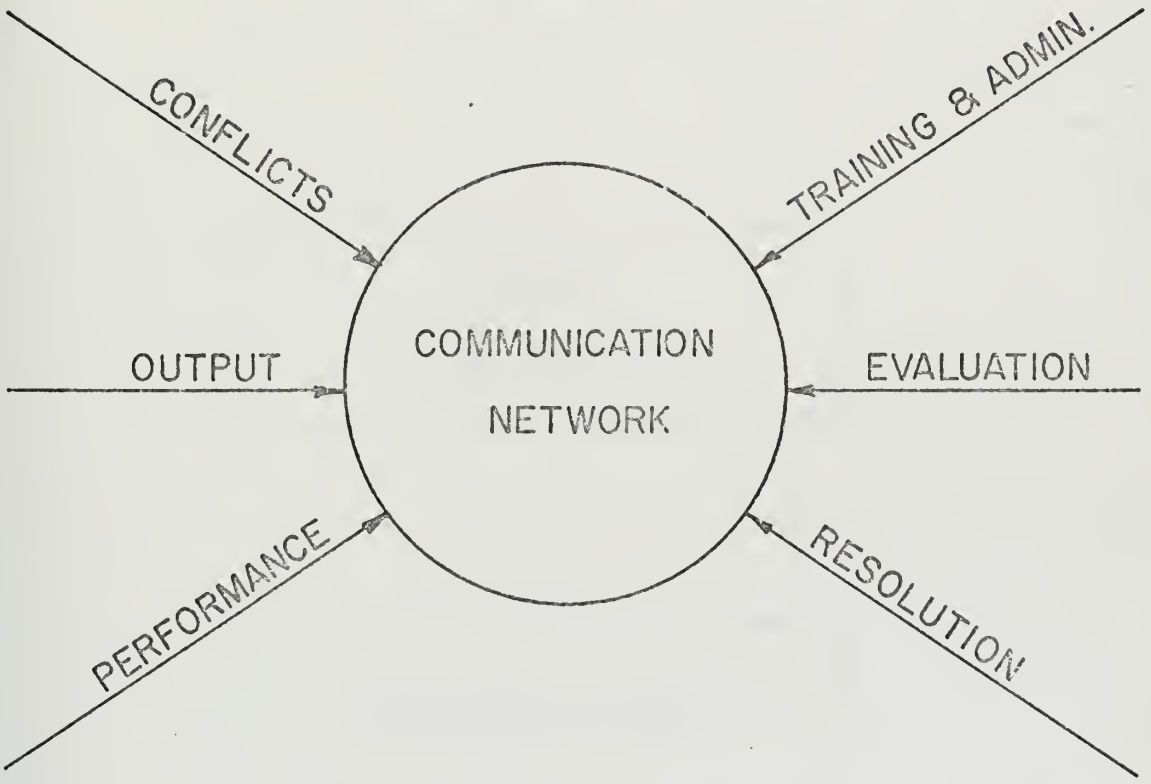

figure (5)

FIRST ITERATION-SUPERVISION PROCESS MODEL

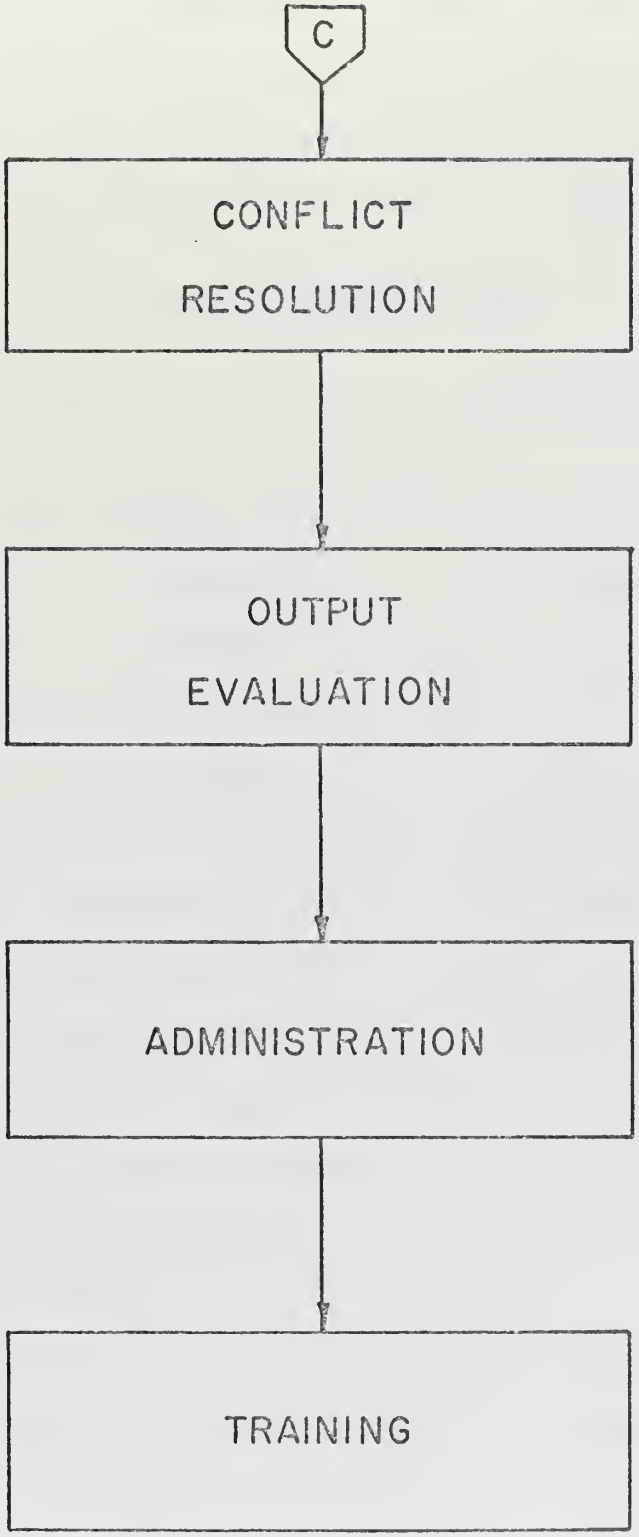

figure (6)

managers' and project managers' skills and provided a guide to the development of the proposed curriculum.

In order to clarify further the management process model, a tabular listing format was used in the derivation of the management disciplines model. The four basic processes of management were used in the table as in the previous flow diagrams to provide proper context.

THE GENERAL MANAGEMENT MODEL

PROCESS OF MANAGEMENT	DISCIPLINES OF MANAGEMENT
I. PLAN:	
a. Differentiate between the successful and unsuccessful elements of an operation; determining the causal relationship of each element.	a. Problem identification and analysis
b. Conception and integration of possible alternative courses of action that might lead to the improvement of historical trends. Optional selection of alternative courses of action leading to improvement of the systems operation.	b. Decision theory analysis
c. Segregation of selected alternative courses of action into those executable with current resources and those requiring major resource configuration changes to accomplish	c. Short- and Long-Range Planning

PROCESS OF MANAGEMENT	DISCIPLINES OF MANAGEMENT
d. Identification of incremental staffing needs to accomplish short- and long-range plans	d. Behavioral Objectives Analysis
e. Identification of incremental non-human resources needs to accomplish short- and long-range plans	e. Logistic Support Requirements Analysis
f. Identification of incremental funding needs to accomplish short- and long-range plans	f. Cost Estimation Analysis
g. Identification of communication requirements necessary to co-ordinate and control resources used in the accomplishment of short- and long-range plans	g. Management Information Systems Analysis
II. ORGANIZE:	
a. Definition of staff duties in terms of responsibilities and authority	a. Position Description and Classification; Structure of Organi-zation
b. Definition of communication system in terms of functional needs	b. Program Control Theory
c. Definition of Logistic Support System in terms of functional needs	c. Decision Theory; Inventory Theory; Feed/Flow Scheduling

PROCESS OF MANAGEMENT	DISCIPLINES OF MANAGEMENT
d. Definition of Financial control mechanisms in terms of functional needs	d. Budget Theory
e. Definition of legal structure of operating system in terms of operating conditions	e. Corporate Law; Proposal Formulation; evaluation, and award
III. ENERGIZE:	
a. Release capital funding	a. Cost Accounting Theory
b. Select and activate staff	b. Personnel Selection Theory
c. Obtain and feed non-human resources within constraints of legal structure	c. Procurement, Production, and Assembly
d. Activate Data Base with historical data and implement program control	d. Programming and Computing
IV. SUPERVISE:	
a. Resolve conflicts through analysis and decision	a. Conflict Management Theory
b. Guide and maintain competent staff	b. Personnel Training and Administration
c. Monitor Communication System	c. Exception Management
d. Evaluate short- and long-range plans against actual performances; taking remedial action as necessary	d. Configuration Management
e. Protect legal structure	e. Contract Administration

IV. THE NATURE OF PROJECT MANAGEMENT

The key to the identification of the nature of a project manager's application of management disciplines is found in the nature of the decisions he makes. A study of 20 major companies throughout the United States which use the "Project Management Techniques" indicated that the crucial project decisions are:

A. PLANNING

1. Assign priorities to work in support areas
2. Determine content of original proposal

B. ORGANIZATION

1. Arrive at "Make or Buy" decisions
2. Hire additional personnel, even to the extent of exceeding ceilings when a crash effort is indicated

C. ENERGIZATION

1. Initiate work in support areas
2. Select contractors

D. SUPERVISION

1. Relax performance requirements
2. Authorize contractors to exceed cost, schedule or scope of work
3. Contract change in schedule, cost or scope
4. Cancel contracts or propose termination
5. Authorize exceeding of funding appropriated to the project.[10]

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[10] Goodman, R. A., "Ambiguous Authority Definition In Project Management," Academy of Management Journal, Vol. 10, No. 4, December, 1967, p. 395.

Since there is a wide variety of positions that could be considered as traditional management roles, it was necessary to select one type for comparison with the project manager. The typical small factory production manager was selected.

With these things in mind, comparison Table I was constructed. This comparison table showed that the primary differences in application of management disciplines by project managers were:

1. A moderate increase in authority and large change in environmental exposure in the planning process

2. A significant increase in scope of authority in the organizational process

3. A major increase in scope of action with some authority increase in the energization process

4. A slight reduction in the scope of action and environmental exposure and a marked increase in authority in the supervision process.

TABLE I

MANAGEMENT MODEL

(Disciplines of Management)	APPLICATIDN DF TRADITIONAL MANAGER	APPLICATION OF PRDJECT MANAGER	CHANGE IN SCDPE FOR PRDJECT MANAGER
Planning Processes:			
A. Problem Identification and Analysis	Defined Limited Internal Data Base with historical content	Complex Internal/External Data Base with little historical content	+ Scope of Action and Environment
B. Decision Theory Analysis	Internal, Limited problem Base - Sequential Decisions	Internal/External Problem Base — Parallel Decisions	+ Environment
C. Short- and Long-Range Planning	On-going operation with historical Data Base	Defined/Limited Life Dperation	+ Environment
D. Behavioral Objectives Analysis	Single, defined purpose	Multiple, complex purposes	+ Environment
E. Logistic Support Requirements Analysis	Directed Needs — Defined Scope	Multiple needs — undefined, complex scope	+ Environment
F. Cost Estimation Analysis	Follow-on, series development	Parallel, initial development	+ Scope of Action and Authority
G. Management Information Systems Analysis	Follow-on, consultative, series development	Initiative, Parallel Development	+ Authority
Organization Processes:			
A. Position Description and Classification — Organizational Structures	Formalized structure — Directed Functions with firm standards	Informal structure — emphasis on small staff with wide talent base	+ Scope of action
B. Program Control Theory	User	Designer	+ Authority
C. Make or Buy Theory — Feed/Flow Scheduling. Inventory Management	Developer	Dbserver - critic	+ Authority
D. Budgeting Theory	User	Developer	+ Authority

TABLE I (Continued)

MANAGEMENT MODEL (Disciplines of Management)	APPLICATION OF TRADITIONAL MANAGER	APPLICATION OF PROJECT MANAGER	CHANGE IN SCOPE FOR PROJECT MANAGER
Organization Processes:			
E. Corporate Law — Proposal, Formulation, Evaluation, and Award	Regulated	Regulator	+ Authority
Energization Processes:			
A. Cost Accounting	User	Developer	+ Authority
B. Personnel Selection Theory	Consultative	Implementer	+ Authority
C. Procurement, Production, and Assembly	Designer-Implementor	Coordinator	+ Scope of Action
D. Programming and Computing	User	Designer	+ Scope of Action
Supervision Processes:			
A. Conflict Management Theory	Limited, Directed	Complex, unlimited	+ Authority - Scope of Action
B. Personnel Training and Administration	Tight rein, Directed	Loose rein, Informal	- Scope of Action
C. Exception Management	Direct Control and contact	Indirect Control and contact	- Environment
D. Configuration Management	Regulated	Regulator	+ Authority
E. Contract Administration	Regulated	Regulator	+ Authority

V. THE COURSE ELEMENT EVALUATION MATRIX

The next step of the study was to set up a course evaluation matrix. Using the "Disciplines of Management Model" as evaluation criteria and the project manager differences as amplifying factors, all courses of the Management Curriculum and all potentially applicable courses from the Operations Analysis and Computer Science Curriculum were evaluated to determine their utility in a project management curriculum.

This evaluation was accomplished by establishing the "Disciplines of Management Model" as the column elements in a decision matrix. The row elements of this matrix consisted of the individual instructional elements of the following material:

A. Established Naval Postgraduate School courses in the Management Science, Computer Systems Management, Computer Sciences, and Operations Research Curricula

B. Proposed Project Management Curriculum

C. Other course material external to the Naval Postgraduate School, including:

1. AFIT Weapons System Acquisition Course
2. ICAF Management Series
3. Elements of Management for Engineering Duty Officers

A simple binary code was utilized in the evaluation process. A "1" indicated that a particular course element was applicable to a particular project management discipline. A "0" indicated that the course element did not apply. By horizontal summation of the completed matrix, it is possible to derive a value for each element of a given course and, by summation over the elements, a value for the course itself. By selecting

the highest valued courses that will fit a six-quarter curriculum and then summing their values vertically, the degree of balance in relation to project management disciplines is obtained. Although it was not possible to determine absolute criteria for optimal balancing of these disciplines, this matrix analysis allowed the detection and adjustment of gross inequities.

Figure 7 is a specimen of the matrix used in course evaluation and curriculum balancing.

COURSE ELEMENT EVALUATION MATRIX

TOTALS								COURSE ELEMENTS NO.	ELEMENTS OF PROJECT MANAGEMENT
									PROBLEM IDENT. AND ANALYSIS
									DECISION THEORY ANALYSIS
									SHORT & LONG RANGE PLANNING
									BEHAVIORAL OBJECTIVES ANALYSIS
									LOGISTIC SUPPORT RQR. ANALYSIS
									COST ESTIMATION PROCESSES
									MGMT. INFO. SYS. ANALYSIS
									POSITION DESCRIP. & CLASS.
									ORG. STRUCTURE ANALYSIS
									PROGRAM CONTROL THEORY
									INVENTORY MGMNT. THEORY
									FEED / FLOW SCHEDULING
									BUDGET THEORY
									PERSONNEL SELECTION THEORY
									PROGRAMMING & COMPUTING
									PROCUREMENT, PRODUCTION; ASSY
									COST ACCOUNTING THEORY
									COORDINATION
									PERSONNEL TRGN. & ADMIN.
									EXCEPTION MGMNT.
									CONFIGURATION MGMNT.

Fig. 7

VI. THE CURRICULUM DEVELOPMENT

A. THE BASIC CURRICULUM

Once a workable group of courses had been determined, it was next necessary to mould them into the curriculum that would best accomplish the dual objectives set at the beginning of the study. That is, to produce a graduate having the capacity of functioning effectively within the existing defense acquisition system and the intellectual background to assess and improve the system.

The traditional business school approach is to provide necessary technical tools in the early part of the curriculum and to devote the latter part of the program to case studies and problem-oriented courses. This seems to fall somewhat short of providing the desired immediate practical capability. While it does provide a degree of synthesis, for the average student it leaves many of the technical tools as ends in themselves rather than as useful means to accomplish a managerial task. The project task orientation was devised to address this problem. By tying individual courses into the project management core and examining current applications as early in the program as possible, it becomes necessary for students to exercise all the basic tools of management concurrently with, or very shortly after, their introduction. Because of the desire to present a project in chronological sequence, and the sophisticated decision techniques desirable in the planning stage of the project, it was not possible to begin the input-output sequence in the first quarter. Therefore, the first project management core course was selected to be a weekly meeting between the students and the coordinating

professor to establish rapport, familiarize the student with organization for national defense, establish the environment in which Navy project managers operate, and introduce the somewhat novel philosophy of the Naval Postgraduate School Weapons Systems Acquisition Curriculum.

The curriculum in Quarter Two through Quarter Five was built about the project management core. The students are provided with a series of program inputs beginning with a directive to establish the project office, proceeding through a life cycle, and ending with a directive to terminate the project. Technical and managerial theory courses are timed to provide the students with the necessary background to address the inputs. The core courses integrate the tools with the requirements and enable the students to respond with appropriate documentation.

It was determined that approximately 200 hours of instructional time would be devoted to testing activities required to establish individual grades if conventional student evaluation techniques were used. This time has minimal instructional value, and the resulting grade assignments do not correlate highly with later job performance. Therefore, it is recommended that student evaluation be based on the quality of the output documents. As students would be working in teams to produce the required outputs, rotation of team membership would be required to establish individual grades.

The final quarter was reserved primarily for development of a thesis in Weapons Systems Acquisition or a closely related field. The project management core would continue on a seminar basis, allowing students to interchange results of their research and providing an opportunity to critique on-going Chief of Naval Material projects. This time will provide an opportunity, unique within the Department of the Navy, for examining

the frontiers of weapons systems acquisition techniques. Active participation of the agencies of the Naval Material Command is crucial to the success of this phase of the curriculum. Access to actual project files is essential to develop insights and improvements in the weapons acquisition process.

B. THE SUBSPECIALTY OPTIONS

Section II specified the three levels of project management relevant to the Navy's acquisition program. The core curriculum provides the main body of information that will enable these levels to interface knowledgeably with each other. The subspecialty options provide the opportunity to gain a more intimate working knowledge of the level most appropriate to the student's desires and prospective assignments.

1. The Research and Development Option

Completion of the Research and Development option requires a course in Defense Requirements Analysis in Quarter Four and a course in Research and Development Management in Quarter Five. This allows the student three elective courses during the curriculum. The Research and Development manager will be making decisions that require thorough knowledge of the state-of-the art in his technical field. His electives, therefore, should be devoted to updating his engineering knowledge.

2. The Industrial Option

Completion of the Industrial option requires a course in Corporate Strategy in Quarter Four and a course in Introduction to Logistics and Supply Systems in Quarter Five. This allows the student three elective courses during the curriculum.

3. The Audit and Administrative Option

Completion of the Audit and Administrative option requires a course in Agency in Quarter Four and Contract Appeals in Quarter Five. Again, this allows the student three elective courses during the curriculum.

C. ELECTIVES

An implicit goal at the outset of this study was to maintain as much flexibility as possible by maximizing the students' opportunities to select their own programs. This would acknowledge the generally high level of maturity possessed by the students at the Naval Postgraduate School and would tend to keep the students' motivation at a high level. However, the core and subspecialty courses selected are an irreducible minimum to cover the vast body of theoretical and applied material pertinent to Weapons Systems Acquisition. It has been shown that this leaves only three electives open to students throughout the six-quarter program. Additionally, the outputs from the project management core courses and the development of a thesis are essentially open-ended efforts. Any electives taken as an overload must, of necessity, reduce the time available that a student can expend on these efforts. Therefore, electives taken in addition to those allowed within the framework of the proposed curriculum should be generally discouraged. Within these limitations it is recommended that the student be allowed to take any course within the school in which he is interested and qualified.

VII. THE CURRICULUM

The curriculum resulting from the process and considerations described above is graphically portrayed in Figure 8 through Figure 13. Detailed description of the courses included is found in Appendix A.

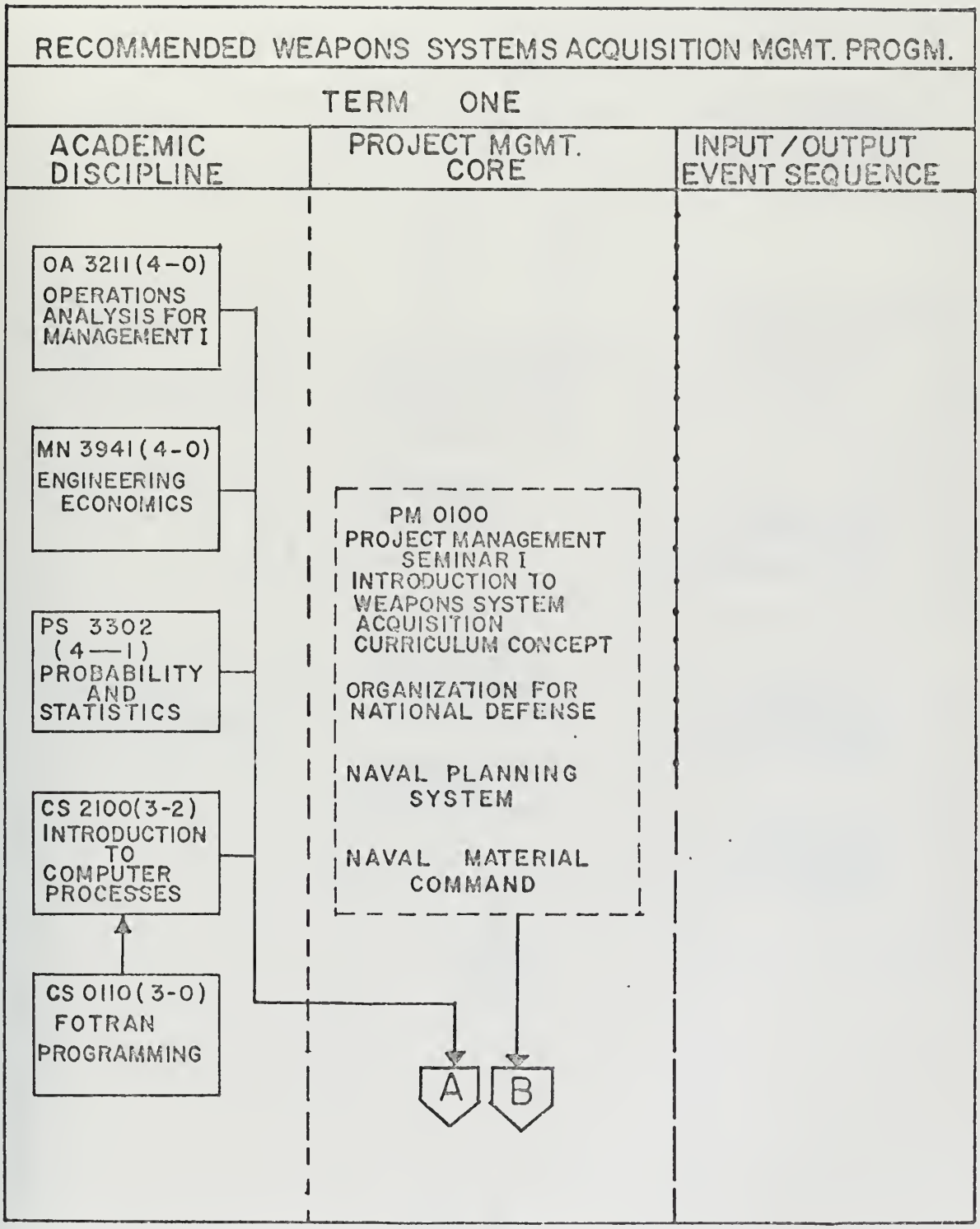
RECOMMENDED WEAPONS SYSTEMS ACQUISITION MGMT. PROGM.
TERM ONE
ACADEMIC DISCIPLINE
PROJECT MGMT. CORE
INPUT / OUTPUT EVENT SEQUENCE
OA 3211 (4-0) OPERATIONS ANALYSIS FOR MANAGEMENT I
MN 3941 (4-0) ENGINEERING ECONOMICS
PS 3302 (4—1) PROBABILITY AND STATISTICS
CS 2100 (3-2) INTRODUCTION TO COMPUTER PROCESSES
CS 0110 (3-0) FOTRAN PROGRAMMING
PM 0100 PROJECT MANAGEMENT SEMINAR I
INTRODUCTION TO WEAPONS SYSTEM ACQUISITION CURRICULUM CONCEPT
ORGANIZATION FOR NATIONAL DEFENSE
NAVAL PLANNING SYSTEM
NAVAL MATERIAL COMMAND
A
B

Fig. 8

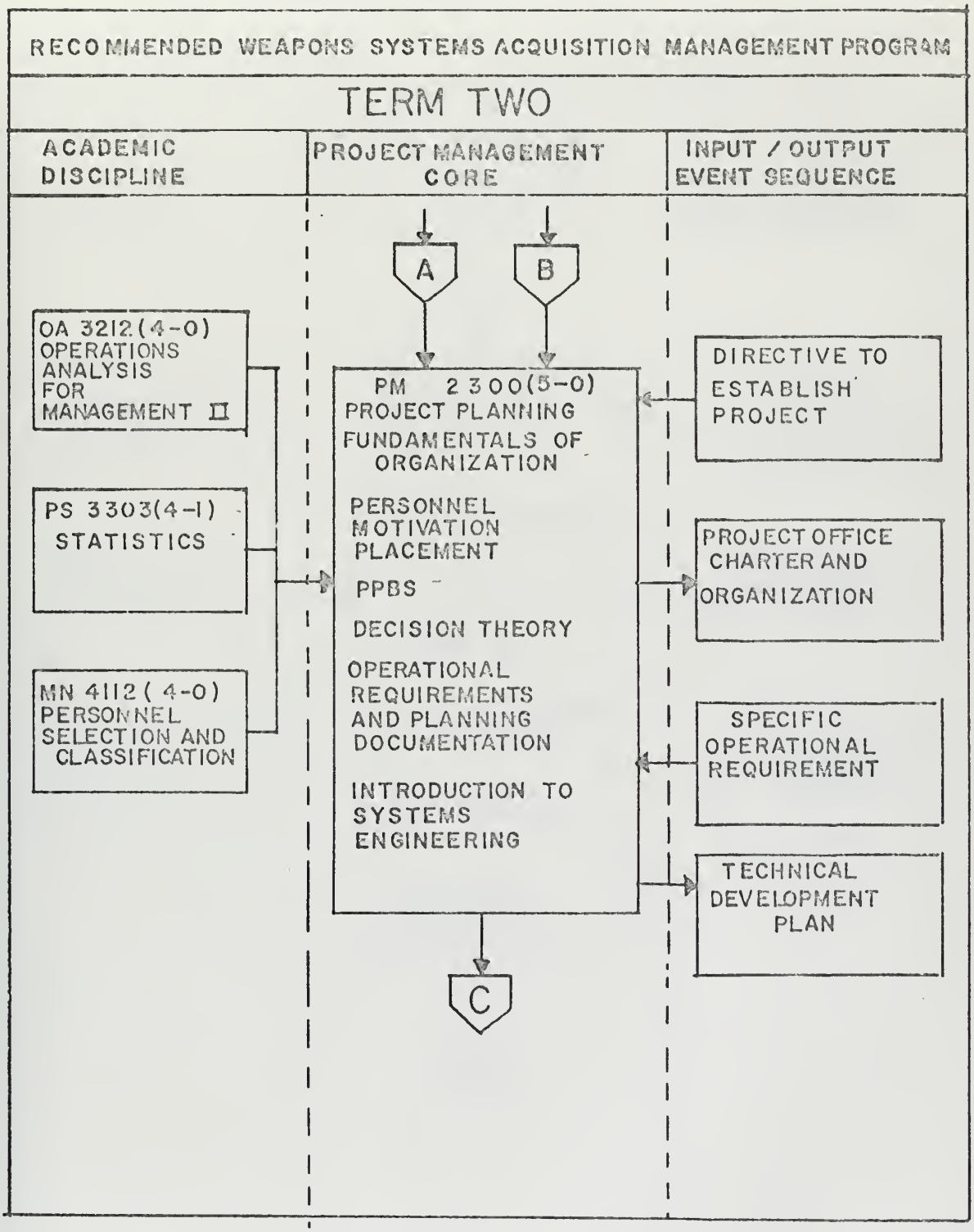
RECOMMENDED WEAPONS SYSTEMS ACQUISITION MANAGEMENT PROGRAM
TERM TWO
ACADEMIC DISCIPLINE
PROJECT MANAGEMENT CORE
INPUT / OUTPUT EVENT SEQUENCE
A
B
OA 3212 (4-0) OPERATIONS ANALYSIS FOR MANAGEMENT II
PS 3303(4-1) STATISTICS
MN 4112 (4-0) PERSONNEL SELECTION AND CLASSIFICATION
PM 2300(5-0)
PROJECT PLANNING
FUNDAMENTALS OF ORGANIZATION
PERSONNEL MOTIVATION PLACEMENT
PPBS
DECISION THEORY
OPERATIONAL REQUIREMENTS AND PLANNING DOCUMENTATION
INTRODUCTION TO SYSTEMS ENGINEERING
C
DIRECTIVE TO ESTABLISH PROJECT
PROJECT OFFICE CHARTER AND ORGANIZATION
SPECIFIC OPERATIONAL REQUIREMENT
TECHNICAL DEVELOPMENT PLAN

Fig. 9

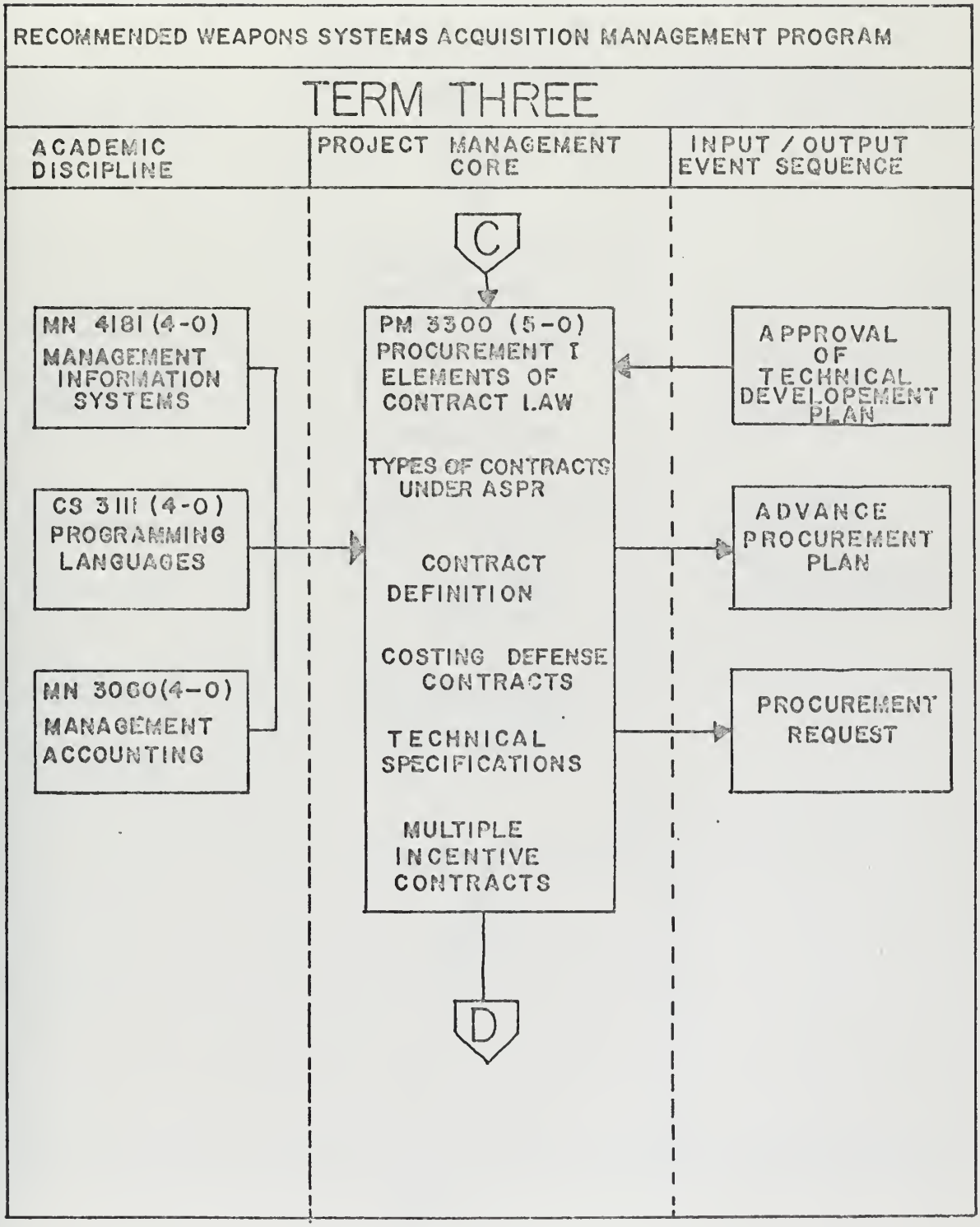
RECOMMENDED WEAPONS SYSTEMS ACQUISITION MANAGEMENT PROGRAM
TERM THREE
ACADEMIC DISCIPLINE
PROJECT MANAGEMENT CORE
INPUT / OUTPUT EVENT SEQUENCE
C
MN 4181 (4-0) MANAGEMENT INFORMATION SYSTEMS
CS 3111 (4-0) PROGRAMMING LANGUAGES
MN 3060(4-0) MANAGEMENT ACCOUNTING
PM 3300 (5-0) PROCUREMENT I ELEMENTS OF CONTRACT LAW
TYPES OF CONTRACTS UNDER ASPR
CONTRACT DEFINITION
COSTING DEFENSE CONTRACTS
TECHNICAL SPECIFICATIONS
MULTIPLE INCENTIVE CONTRACTS
D
APPROVAL OF TECHNICAL DEVELOPEMENT PLAN
ADVANCE PROCUREMENT PLAN
PROCUREMENT REQUEST

Fig. 10

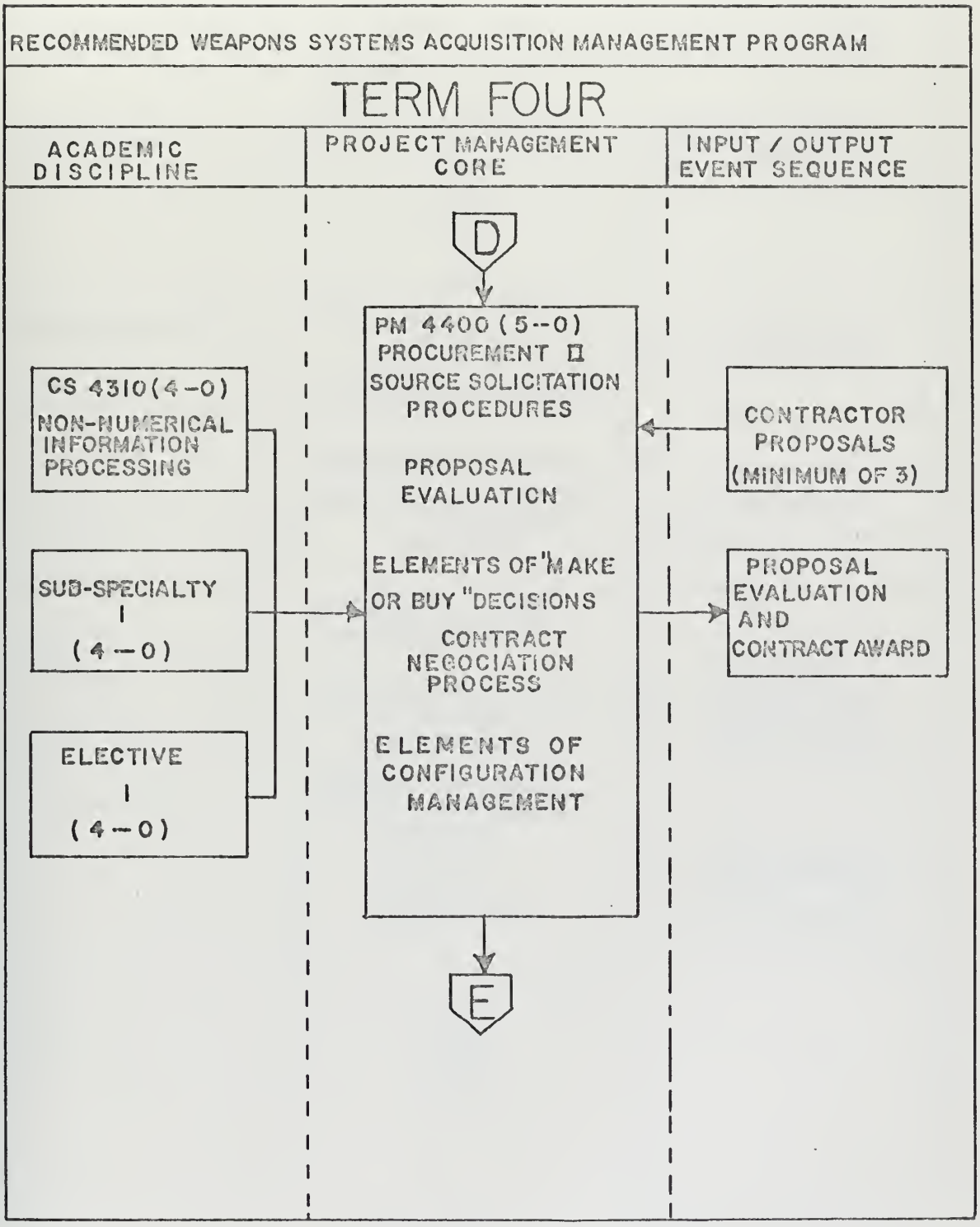
RECOMMENDED WEAPONS SYSTEMS ACQUISITION MANAGEMENT PROGRAM
TERM FOUR
ACADEMIC DISCIPLINE
PROJECT MANAGEMENT CORE
INPUT / OUTPUT EVENT SEQUENCE
D
PM 4400 (5--0) PROCUREMENT & SOURCE SOLICITATION PROCEDURES
PROPOSAL EVALUATION
ELEMENTS OF "MAKE OR BUY" DECISIONS
CONTRACT NEGOCIATION PROCESS
ELEMENTS OF CONFIGURATION MANAGEMENT
E
CS 4310 (4-0) NON-NUMERICAL INFORMATION PROCESSING
SUB-SPECIALTY I (4-0)
ELECTIVE I (4-0)
CONTRACTOR PROPOSALS (MINIMUM OF 3)
PROPOSAL EVALUATION AND CONTRACT AWARD

Fig. 11

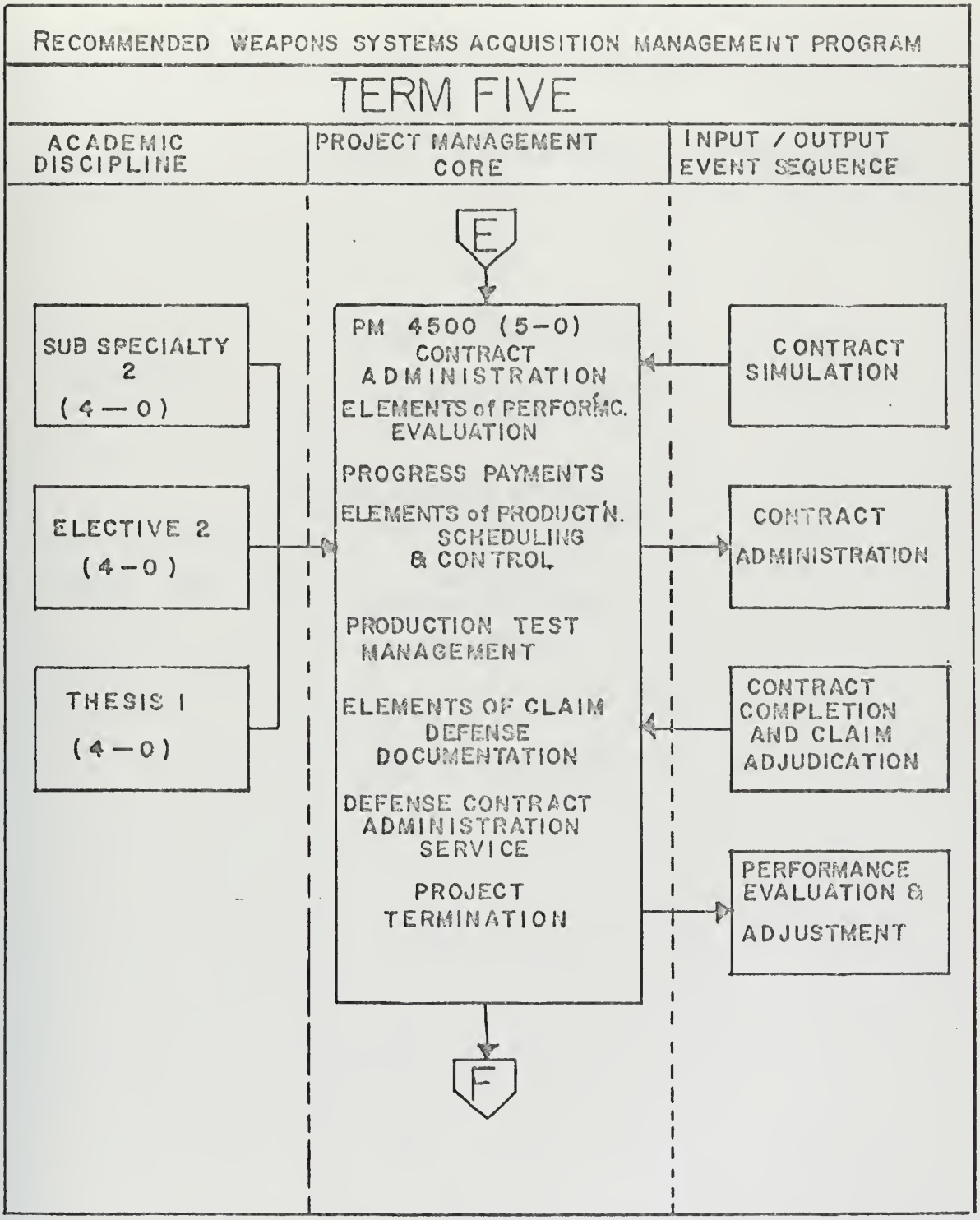
RECOMMENDED WEAPONS SYSTEMS ACQUISITION MANAGEMENT PROGRAM
TERM FIVE
ACADEMIC DISCIPLINE
PROJECT MANAGEMENT CORE
INPUT / OUTPUT EVENT SEQUENCE
E
SUB SPECIALTY 2 (4 — 0)
ELECTIVE 2 (4 — 0)
THESIS I (4 — 0)
PM 4500 (5—0) CONTRACT ADMINISTRATION
ELEMENTS of PERFORMC. EVALUATION
PROGRESS PAYMENTS
ELEMENTS of PRODUCTN. SCHEDULING & CONTROL
PRODUCTION TEST MANAGEMENT
ELEMENTS OF CLAIM DEFENSE DOCUMENTATION
DEFENSE CONTRACT ADMINISTRATION SERVICE
PROJECT TERMINATION
F
CONTRACT SIMULATION
CONTRACT ADMINISTRATION
CONTRACT COMPLETION AND CLAIM ADJUDICATION
PERFORMANCE EVALUATION & ADJUSTMENT

Fig. 12

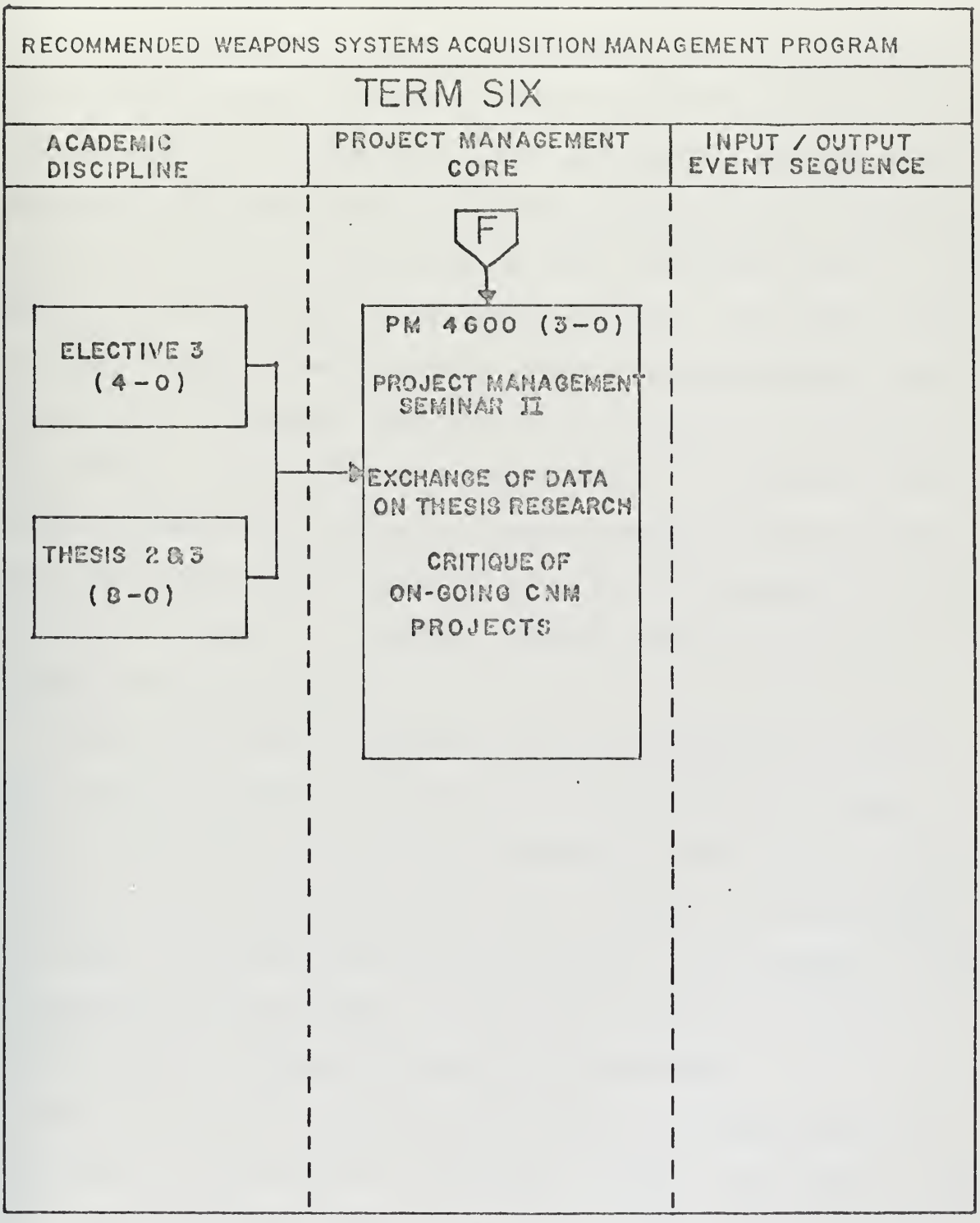
RECOMMENDED WEAPONS SYSTEMS ACQUISITION MANAGEMENT PROGRAM
TERM SIX
ACADEMIC DISCIPLINE
PROJECT MANAGEMENT CORE
INPUT / OUTPUT EVENT SEQUENCE
F
ELECTIVE 3 (4-0)
THESIS 2&3 (8-0)
PM 4600 (3-0)
PROJECT MANAGEMENT SEMINAR II
EXCHANGE OF DATA ON THESIS RESEARCH
CRITIQUE OF ON-GOING CNM PROJECTS

Fig. 13

APPENDIX A: COURSE SPECIFICATION SHEETS

This Appendix provides a detailed breakdown of each required course in the Weapons Systems Acquisition Curriculum, including required subspecialty courses. The four core project management courses embody the approach which differentiates this curriculum from any other, hence they are described in greater detail than the more conventional courses. The course specification sheets are arranged by quarters. Each sheet includes a listing of course elements together with the recommended hours of instruction for the element, prerequisites for the course, a recommended course format, and a listing of reference material. In the case of the project management core courses, the course elements are further broken down into specific topics and the related information repeated at this finer level of detail. In addition, terminal behavior objectives are listed for the core courses.

Elements for project management courses in the subspecialty areas were selected to provide the required expertise appropriate to these areas. Elements for existing Naval Postgraduate School courses are those listed in the NPS Catalogue for 1970-1972. Estimated instructional hours for elements are based on the relative importance of the elements as shown in the course evaluation matrix, modified where necessary to provide adequate time for a coherent presentation of the element.

Specification to this level of detail permits the identification of redundancies and deficiencies, and provides a highly visible baseline from which the coordinating professor can make the changes that will inevitably be required as a result of experience with the curriculum.

WEAPONS SYSTEMS ACQUISITION CURRICULUM — QUARTER I

(see Figure 8, page 38)

COURSE SPECIFICATION SHEET

TITLE: SEMINAR IN PROJECT MANAGEMENT I (PM 0100)

Course Description:

Elements	Estimated Hours of Instruction
1. Introduction to the Project Management Curriculum Concept	3
2. Organization for National Defense	2
3. The Naval Planning System .	3
4. The Naval Material Command	4

Prerequisites: None

Recommended Course Format:

(1) Lecture and recitation

(2) Group discussion utilizing prior experience by students in related fields

References:

(1) Yoshpe, H. G. and Bauer, T. W., Defense Organization and Management, Washington, Industrial College of the Armed Forces, 1967.

(2) OPNAVINST 5000.19 (Series), "The Navy Planning and Programming System."

(3) Assistant Secretary of the Navy (R & D), NAVSO P-2457(Rev 7-69), Department of the Navy RDT&E Management Guide, Washington, D. C., 1969.

COURSE SPECIFICATION SHEET

TITLE: OPERATIONS ANALYSIS FOR MANAGEMENT I (OA 3211)

Course Description:

Elements	Estimated Hours of Instruction
1. Network Analysis	12
2. Inventory Models	8
3. Matrix Pay-Off Games	10
4. Simplex Algorithm, Duality Dual Simplex Algorithm	12
5. Sensitivity Analysis	4

Prerequisites:

PS 3000 is required by the department. This course will be taken concurrently with PS 3302. This may necessitate a deterministic approach early in the course with probabilistic considerations introduced later.

Recommended Course Format:

(1) Class lecture and recitation

(2) Sample problem solving

References:

(1) Hillier, F. S. and Lieberman, G. J., Introduction to Operations Research, San Francisco, Holden-Day, Inc., 1967.

COURSE SPECIFICATION SHEET

TITLE: ENGINEERING ECONOMICS (MN 3941)

Course Description:

Elements	Estimated Hours of Instruction
1. Alternative Market Models	6
2. Theories of Production	6
3. Technological Considerations	8
4. Production and Cost Functions	12
5. Supply Curves	6
6. Analysis of Investment Decision Problems	10

Prerequisites:

Current requirement is MN 3030. A course in Probability and Statistics is also recommended. The extremely broad brush treatment of MN 3030 suggests that that course, in fact, is designed as a terminal course of Economics to expose students to the field and is not fundamental to following subjects. Its omission would undoubtedly bias the students' view of Economics but should not prejudice their ability to master successfully the material presented in Engineering Economics.

Recommended Course Format:

(1) Class lecture and recitation

References:

(1) Baumol, W. J., Economic Theory and Operations Analysis, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1965.

(2) Thuesen, H. G. and Fabrycky, W. J., Engineering Economy, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1964.

COURSE SPECIFICATION SHEET

TITLE: PROBABILITY AND STATISTICS (PS 3302)

Course Description:

Elements	Estimated Hours of Instruction
1. Independence and Conditional Distributions	8
2. Stochastic inequalities, approximations, and limit properties and their uses in OA/SA	12
3. Distributions of functions of random variables	8
4. Random sampling and distribution of sampling statistics	8
5. Applications to model building and Bayesian techniques	12

Prerequisites:

PS 2301. It is recommended that this requirement be waived in view of the mathematical sophistication inherent in the background of undergraduate engineers.

Recommended Course Format:

(1) Class lecture and recitation

References:

(1) Zehna, P. W., Probability Distributions and Statistics, Boston, Allyn and Bacon, Inc., 1970.

COURSE SPECIFICATION SHEET

TITLE: INTRODUCTION TO COMPUTERS AND PROGRAMMING (CS 2100)

Course Description:

Elements	Estimated Hourse of Instruction
1. Characteristics of general-purpose digital computers	8
2. Fundamentals of programming	8
3. Problem Analysis	8
4. Programming Aids	4
5. Compilers and Assemblers	8
6. Selected numerical and non-numerical problems	12

Prerequisites:

CS 0110. To be taken in review section or concurrently.

Recommended Course Format:

(1) Class lecture and recitation

(2) Practical computer programming interspersed throughout course at increasing level of difficulty

References:

(1) Forsythe, A. I., and others, Computer Science: A First Course, New York, John Wiley and Sons, Inc., 1969.

COURSE SPECIFICATION SHEET

TITLE: FORTRAN PROGRAMMING (CS 0110)

Course Description:

Elements	Estimated Hours of Instruction
1. Basic elements of FORTRAN	20
2. Practical application of principles	16

Prerequisites: None

Recommended Course Format:

(1) Class instruction and recitation

(2) Practical programming

References:

(1) Blatt, E. M., Introduction to FORTRAN IV Programming, Pacific Palisades, California, Goodyear Publishing Co., 1968.

WEAPONS SYSTEMS ACQUISITION CURRICULUM — QUARTER II

(see Figure 9, page 39)

COURSE SPECIFICATION SHEET

TITLE: PROJECT PLANNING (PM 2300)

Course Description:

Elements	Estimated hours of Instruction
1. Fundamentals of Organization	5
2. Personnel motivation and placement	5
3. Planning, programming, and budgeting system in the DOD	8
4. Decision theory	15
5. Operational requirements and planning documentation	15
6. Introduction to Systems Engineering	12

Prerequisites:

None. Normally open only to students in the Weapons Systems Acquisition Curriculum.

Recommended Course Format:

(1) See individual topic specification sheets

Terminal Behavior Objectives:

1. Show, through the organization of the project office, mastery of the principles of establishing an organization appropriate to respond to the directive initiating the project. Further, through the Management Plan (Section 5) of the required TDP, show familiarity with the required organizational interrelationships necessary for the successful completion of the project.

2. Include in this project organization document billet descriptions for each project office billet, together with a summary of the professional and personal attributes necessary for success in each case.

3. a. Students, working in teams, are to prepare a formal briefing showing the DOD PPBS structure and relating their assigned project to the overall defense effort.

b. Demonstrate an adequate grasp of the DOD budgeting system in the Financial Plan (Section 6) of the TDP.

4. Show in the "Narrative of Requirement and Brief Development Plan (Section 4) of the TDP, the decision processes employed in arriving at the recommended plan. Applicable elements of linear programming, Probability and Statistics, and computer processing should be utilized.

5. a. Demonstrate, by means of visual presentation, or Section 4 of the TDP, an understanding of the interrelations among the documents presented in this topic.

b. Demonstrate, by means of preparation of a complete TDP, mastery of this phase of the planning process. Note: Students will be working in teams in the TDP; therefore, no one student will encounter all facets of this document. In view of this limitation, the coordinating professor may prefer to have some TDP sections prepared formally and others presented to the class orally.

The Input-Output Sequence in Quarter II:

1. The initial input to the project management core will be a directive from proper authority to establish a project office. During the first quarter the coordinating professor will have determined the most appropriate managerial area in which to establish the project. Factors entering into this decision will be the students' background,

seniority, interests, and probable area of assignment after leaving the Naval Postgraduate School. A further factor to be considered is the availability of suitable input data in Quarters 3-5.

2. The response to this input will be a charter for this project office. This should include a brief description of the system to be developed, the scope of the project, project manager's authorities, responsibilities, and limitations, the operating relationships with related agencies, and staffing requirements. Associated with the charter, but not necessarily integral with it, will be a project office organization plan showing inter-office relations, establishing billet descriptions, and noting attributes required of individuals assigned to billets. This work should be completed at the end of the fourth week.

3. The second input to the course will be a Specific Operational Requirement. The student response to this will be a Technical Development Plan. It is most desirable that an actual project be identified for use in this exercise, as it will be most difficult to simulate the technical data necessary for incorporation into a TDP. For an actual case, this information will be available in either a Proposed Technical Approach or contractors' technical proposals. Although terminal data are essential to the TDP, the emphasis in TDP development is on the decision techniques and systems analysis work in translating operational requirements to hardware requirements.

Much of the work that takes place at this stage of project development is not reflected in the Terminal Development Plan. A minimum of two presentations should be made to bring out this data. The first would be used to explain the decision processes used in more detail than is possible

in the TDP. The second would be a "big-picture" presentation composed of two related parts. The first would outline the PPBS and fix the position of the exercise project in the overall national defense picture, the second would be a sales pitch for the project aimed at the Assistant SECNAV/DORE decision making level to justify the proposed project budget in terms of the national effort.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Fundamentals of Organization

Description:

Topics	Estimated Hours of Instruction
1. Organization Theory	1
2. Organization Structure	1
3. Organization Analysis	3

Recommended Format:

(1) Present topics through class lectures supported by standard textbook readings

(2) Upon completion of this and the immediately succeeding element, student teams will develop the project management charter and project office organization necessary to respond to Input 1.

References:

(1) Koontz, H. and O'Donnell, C., Principles of Management, New York, McGraw-Hill Book Co., 1964.

(2) Sisk, H. L., Principles of Management, Cincinnati, South-Western Publishing Co., 1969.

(3) Assistant Secretary of the Navy (R & D), NAVSO P-2457(Rev 7-69), Department of the Navy RDT&E Management Guide, Washington, D. C., 1969.

(4) Brown, F. R. (ed.), Management: Concepts and Practices, Washington, D. C., Industrial College of the Armed Forces, 1967.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Planning, Programming, Budgeting System in the DOD

Description:

Topics	Estimated Hours of Instruction
1. DOD Planning Process	2
2. Budget Process Prior to PPBS	1
3. Defense Programs	1
4. Program Budgeting	2
5. The Federal Budget Cycle	2

Recommended Format:

(1) Present topics through class lectures. Note how this material contributes to the development of the Summary and Financial Planning Sections on the TDP

References:

(1) Novick, D., Program Budgeting in the Department of Defense, Santa Monica, California, The RAND Corporation, Memorandum RM-4210-RC, September 1964.

(2) Laird, M. R., "Defense Budget Highlights, The Secretary's Summary," Defense Industry Bulletin, April, 1970.

(3) Bureau of Naval Personnel (NAVPERS 10792-B(INT)), Financial Management in the Navy, Washington, D. C., December, 1966.

(4) Yoshpe, H. G. (ed.), Requirements: Matching Needs With Resources, Washington, D. C., Industrial College of the Armed Forces, 1964.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Decision Theory

Description:

Topics	Estimated Hours of Instruction
1. Decision-making without observed data	3
2. Decision-making with data	3
3. Tests of Hypotheses	5
4. Linear Regression	3
5. Choice of Distribution Functions	1

Recommended Format:

(1) Topics are introduced by lecture. Main thrust of presentation is to tie together elements of Probability and Statistics and Linear Programming and demonstrate their application to the specific operational requirement, which is distributed at the start of this element.

(2) Students demonstrate knowledge of Decision Theory by utilizing it in preparation of the "Narrative of Requirement and Brief Development Plan" section of the required TDP.

(3) The rationale for decisions embodied in the TDP may be further explained in a visual presentation at the discretion of the coordinating professor.

References:

(1) Hillier, F. S., and Lieberman, G. J., Introduction to Operations Research, San Francisco, Holden-Day, Inc., 1967.

(2) Rapoport, Anatole, Strategy and Conscience, New York, Schocken, 1967.

(3) Bain, J., Introduction to Systems Planning, Wright-Patterson AFB, Ohio, Ohio State University Research Foundation, 1969.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Operational Requirements and Planning Documentation

Description:

Topics	Estimated Hours of Instruction
1. Planning for Technology Base Development	1
2. Planning for Operational Capability Development	12
3. Planning for Logistic Support	2

Recommended Format:

(1) Topic 1 is presented by lecture.

(2) Topic 2 includes the Introduction to the Technical Development Plan. Other topics, e.g. TSOR's, PTA's, ADO's, and SOR's are shown in relation to the TDP in one hour. A second hour is devoted to DCP's. The remaining 10 hours are devoted to a thorough examination of the sections of the TDP. The major student effort for the quarter is devoted to developing a TDP response to an SOR provided by the coordinating professor. This TDP is due at the end of week 12 and should incorporate all significant elements of instruction encountered in Quarters 1 and 2, including appropriate use of the computer as an aid in management and decision making.

References:

(1) Assistant Secretary of the Navy (R & D), NAVSO P-2457(Rev 7-69), Department of the Navy RDT&E Management Guide, Washington, D. C., 1969.

(2) Chief of Naval Material, Guide for the Preparation of Technical Development Plans, Washington, D. C., July, 1965.

(3) OPNAVINST 3900.6 (Series), "SOR and TSOR: Instructions for Preparation Of."

(4) OPNAVINST 3910.7 (Series), "ADO: Procedures For Preparation Of."

(5) OPNAVINST 3910.8 (Series), "PTA's For New Systems and Components."

COURSE ELEMENT SPECIFICATION SHEET

Element:

Introduction to Systems Engineering

Description:

Topic	Estimated Hours of Instruction
1. Formulation of conceptual equipment configuration	2
2. Interface compatibility considerations	2
3. Integration of reliability, maintainability, standardization, safety, human, and other factors into the total engineering effort	6
4. Engineering responsibility throughout acquisition	2

Recommended Format:

(1) Each topic is introduced by class lecture

(2) Student teams apply principles to development of appropriate sections of TDP as quarter progresses.

References:

(1) Chestnut, Harold, Systems Engineering Tools, New York, John Wiley and Sons, 1964.

(2) Peck, M. J. and Scherer, F. M., The Weapons Acquisition Process, Boston, Harvard University, 1962.

(3) Dommasch, D. O., and Laudeman, C. W., Principles Underlying Systems Engineering, New York, Pitman Publishing Corporation, 1962.

(4) Kline, M. B. and Lifson, M. W., "Systems Engineering Management," (lecture notes), U.C.L.A., 1970.

COURSE SPECIFICATION SHEET

TITLE: OPERATIONS ANALYSIS FOR MANAGEMENT II (OA 3212)

Course Description:

Elements	Estimated Hours of Instruction
1. Queueing	12
2. Reliability	10
3. Linear and Dynamic Programming	12
4. Gaming	12

Prerequisites:

OA 3211

Recommended Course Format:

(1) Class lecture and recitation

(2) Sample problem solving

References:

(1) Churchman, C. W., Introduction to Operations Research, New York, John Wiley and Sons, 1964.

COURSE SPECIFICATION SHEET

TITLE: STATISTICS (PS 3303)

Course Description:

Elements	Estimated Hours of Instruction
1. Confidence interval testing	4
2. Hypothesis testing	4
3. Regression and correlation analysis	6
4. Analysis of variance	6
5. Non-Parameteric inference	4
6. Applications to reliability, quality assurance, and Operations Analysis problems	20

Prerequisites:

PS 3302

Recommended Course Format:

(1) Class lecture and recitation

References:

(1) Zehna, P. W., Probability Distributions and Statistics, Boston, Allyn and Bacon, Inc., 1970.

COURSE SPECIFICATION SHEET

TITLE: PERSONNEL SELECTION AND CLASSIFICATION (MN 4112)

Course Description:

Elements	Estimated Hours of Instruction
1. Methods for measuring and predicting performance of members of organizations	10
2. Methods of measuring differences between individuals	10
3. Techniques for studying and recording job behavior	12
4. Strategies for personnel decisions	12

Prerequisites:

MN 3110 (Individual Behavior) and PS 3000. It is recommended that MN 3110 be waived. The PS 3302-3303 series is more than the equivalent of PS 3000.

Recommended Course Format:

(1) Class lecture and recitation for methods and techniques

(2) Case studies in strategies for personnel decisions

References:

(1) Thorndike, R. L., Personnel Selection, New York, Wiley and Sons, 1949.

(2) Dunnette, M. D., Personnel Selection and Placement, Belmont, California, Wadsworth Publishing Co., Inc., 1966.

(3) Cronbach, L. J. and Gleser, G. C., Psychological Tests and Personnel Decisions, Urbana, Illinois, University of Illinois Press, 1965.

(4) Guion, R. M., Personnel Testing, New York, McGraw-Hill, Inc., 1965.

WEAPONS SYSTEMS ACQUISITION CURRICULUM — QUARTER III

(see Figure 10, page 40)

COURSE SPECIFICATION SHEET

TITLE: PROCUREMENT I (PM 3300)

Course Description:

Elements	Estimated Hours of Instruction
1. Elements of Contract Law	10
2. Types of Contracts under ASPR	5
3. Contract definition	10
4. Costing Defense Contracts	12
5. Technical Specifications	3
6. Multiple Incentive Contracting	15

Prerequisites:

None. Normally open only to students in the Weapons Systems Acquisition Curriculum.

Recommended Course Format:

See individual course element specification sheets

References:

(1) Pace, D. F., Negotiation and Management of Defense Contracts, New York, Wiley-Interscience, 1970. Includes material applicable to all elements.

(2) See individual Course Element Sheets for additional references.

Terminal Behavior Objectives:

1. Students will demonstrate mastery of procurement planning by producing an advanced procurement plan showing, in detail, how they expect to carry out the provisions of the approved technical development plan.

2. Students will demonstrate knowledge of procurement techniques by producing a complete procurement request. Special attention will be

given to selection of types of contracts to be employed and justification for the selection.

The Input-Output Sequence in Quarter III:

1. The input to the third quarter is approval of the Technical Development Plan developed in the second quarter, together with a funding profile provided by the coordinating professor. In the event that the student TDP is inadequate, a satisfactory document should be substituted at this point to keep the project management core course sequence on track.

2. The student response to TDP approval will be to develop an Advanced Procurement Plan and a detailed procurement request. The APP should be completed at the end of week 5, and the remainder of the quarter devoted to the procurement request. A simulated bidders conference may be utilized to determine how thoroughly elements of the PR are understood.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Types of Contracts Under ASPR

Description:

Topic	Estimated Hours of Instruction
1. Fixed price variations	1
2. Cost plus variations	2
3. Miscellaneous types	1
4. Schedule and general provisions	1

Recommended Format:

(1) Each topic will be presented by class lecture. Students will select appropriate contract types in developing the Advanced Procurement Plan and procurement request required as outputs in Quarter 3.

References:

(1) Assistant Secretary of the Navy (R & D), NAVSO P-2457(Rev 7-69), Department of the Navy RDT&E Management Guide, Washington, D. C., 1969.

(2) Chief of Naval Material, Defense Procurement Handbook, NAVMAT P-12400.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Elements of Contract Law

Description:

Topic	Estimated Hours of Instruction
1. The nature of an offer and an acceptance	1
2. The nature of contractual consideration	1
3. The nature of contractual agreement	1
4. The legal franchise of a government contracting officer	1
5. Personal liability of a government agent	1
6. The nature of contractual default	1
7. The nature of contractual breach	1
8. The components of a government contract	1
9. Contract termination	1

Recommended Format:

(1) All topics should be covered by class lecture; supported with case studies.

References:

(1) Department of Defense, Armed Services Procurement Regulation, Washington, D. C., U. S. Government Printing Office, June 30, 1969.

(2) Armed Services Board of Contract Appeals Proceedings, Washington, D. C., Governemtn Printing Office, Annual Series.

(3) Black's Law Dictionary, Rev. 4th Edition, West Publishing Co., 1968.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Contract Definition

Description:

Topic	Estimated Hours of Instruction
1. Concept formulation	2
2. Advance procurement planning	2
3. Contract definition phases	4
4. Total package procurement concept	2

Recommended Format:

(1) Each topic will be presented by class lecture

(2) Students will utilize information produced in preparation of Advanced Procurement Plan, due at end of week 4.

References:

(1) Naval Material Command, Defense Procurement Management For Technical Personnel, Boston, Harbridge House, Inc., 1970.

(2) SECNAVINST 4200.18, "Advance Procurement Planning."

(3) NAVMATINST 4200.31, "Advance Procurement Planning."

COURSE ELEMENT SPECIFICATION SHEET

Element:

Costing Defense Contracts

Description:

Topic	Estimated Hours of Instruction
1. The importance of reliable costing	1
2. Deriving cost estimates	8
3. Presenting the cost estimate	2
4. Cost estimates as a decision tool	1

Recommended Format:

(1) Each topic will be presented by class lecture

(2) Approximately 4 hours of Topic 2 will be devoted to developing cost estimates for the class Project Procurement request.

References:

(1) Jones, M. V., Systems Cost Analysis: A Management Tool for Decision Making, Bedford, Massachusetts, The Mitre Corporation, TM/04063/0000/00/0/00, July, 1964.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Technical Specifications

Description:

Topic	Estimated Hours of Instruction
1. Military Specifications	1
2. Design Specifications	1
3. Performance Specifications	1

Recommended Format:

(1) Each topic will be presented by class lecture

(2) A major portion of the student work during the quarter will be associated with selecting appropriate levels and developing specifications for the procurement request.

References:

(1) Naval Material Command, Defense Procurement Management For Technical Personnel, Boston, Harbridge House, Inc., 1970.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Multiple Incentive Contracting

Description:

Topic	Estimated Hours of Instruction
1. Types of incentives	3
2. Delivery incentive	3
3. Performance incentive	4
4. Management of incentives	5

Recommended Format:

(1) Each topic is introduced by class lecture

(2) Topics 2, 3, and 4 are examined in detail through case studies.

References:

(1) Pace, D. F., Negotiation and Management of Defense Contracts, New York, Wiley-Interscience, 1970.

COURSE SPECIFICATION SHEET

TITLE: MANAGEMENT ACCOUNTING (MN 3060)

Course Description:

Elements	Estimated Hours of Instruction
1. Basic concepts of Accounting in business and government	20
2. Uses of accounting data by management in planning, controlling, and decision making	24
3. Applications of ADP to accounting systems	4

Prerequisites: None

Recommended Course Format:

(1) Lecture, recitation, and problem solution by students

References:

(1) Horngren, C. T., Accounting for Financial Control, Englewood Cliffs, New Jersey, Prentice-Hall, 1965.

(2) Spiller, E. A., Financial Accounting, Homewood, Illinois, Irwin, Inc., 1966.

COURSE SPECIFICATION SHEET

TITLE: MANAGEMENT INFORMATION SYSTEMS (MN 4181)

Course Description:

Elements	Estimated Hours of Instruction
1. Development and discussion of an integrated information system	20
2. Analysis of actual information systems used in industry and government	24

Prerequisites:

MN 3150 and CS 0110, or consent of instructor. It is recommended that MN 3150 be waived for WSA program students.

Recommended Course Format:

(1) Lecture and recitation for first segment of course.

(2) Case analysis and student presentations for second segment of course.

References:

(1) Johnson, R. A. and others, The Theory and Management of Systems, New York, McGraw-Hill Book Company, 1963.

(2) Schoderbek, R. P., Management Systems, New York, John Wiley and Sons, Inc., 1967.

COURSE SPECIFICATION SHEET

TITLE: PROGRAMMING LANGUAGES (CS 3111)

Course Description:

Elements	Estimated Hours of Instruction
1. Formal definition of a language	4
2. Procedure-oriented language	8
3. Business-oriented language	16
4. String-processing language	4
5. List-processing language	8
6. Conversational language	4

Prerequisites:

CS 0110 or equivalent

Recommended Course Format:

(1) Class lecture and recitation

(2) Practical computer programs in business-oriented and list-processing languages.

References:

(1) Higman, Bryan, Comparative Study of Programming Languages, New York, American Elsevier Publishing Co., Inc., 1967.

(2) Stanford University, ALGOL W Language Description, Palo Alto, California, 1969.

WEAPONS SYSTEMS ACQUISITION CURRICULUM – QUARTER IV

(see Figure 11, page 41)

COURSE SPECIFICATION SHEET

TITLE: PROCUREMENT II, (PM 4400)

Course Description:

Elements	Estimated Hours of Instruction
1. Source solicitation procedures	10
2. Proposal evaluation	14
3. Elements of "Make or Buy" decisions	10
4. Contract negotiation processes	11
5. Elements of configuration management	11

Prerequisites:

PM 3300, Project Management

Recommended Course Format:

(1) See individual course element specification sheets.

References:

(1) The primary text recommended for this course is Negotiation and Management of Defense Contracts by D. F. Pace, Wiley Inter-Science, New York, 1970.

Terminal Behavior Objectives:

(1) Given a case study that reflects the essentials of a Technical Development Plan and a Procurement Request for a simple component, the student must be able to prepare a formal Request for Quote in accordance with the requirements of A.S.P.R.

(2) Given a series of Contractor Performance Evaluation Reports, the student must demonstrate an ability to identify significant common traits of each contractor and to establish and apply a statistical or heuristic ranking system to them.

(3) Given two or more dummy contract proposals, the student must be able to establish proposal evaluation criteria and demonstrate their use with weighted guidelines.

(4) Given a contract change pricing proposal, the student must be able to evaluate the costing techniques utilized and identify sources of error in it.

Input-Output Sequence in Quarter IV:

(1) INPUTS. The Technical Development Plan and Procurement Request used in Quarter III and a minimum of three contract proposals common to an existing Weapons Systems Contract are the inputs to this quarter's work. The detail of the proposals should be kept to a minimum consistent with the terminal behavior objectives stated above. Care should be taken to insure that defects in the proposal are sufficiently detailed to permit identification with reasonable effort and intelligence on the part of the student.

(2) OUTPUTS. The student output of this quarter will be formal proposal evaluation and contract award documentation as prescribed by the "Armed Services Procurement Regulation." The documentation should be required in small segments compatible with the course elements described above.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Source Solicitation Procedures

Description:

Topic	Estimated Hours of Instruction
1. The nature and organization of the DOD source selection hierarchy	1
2. Types and differences of government solicitations	2
3. Differences between technological and economic competition	2
4. Amendments to solicitations	1
5. Product qualification requirements	1
6. Communications with prospective contractors prior to solicitation	2

Recommended Format:

(1) Present topics through class lectures supported by selected readings. Supply students with a case study that depicts potential supply of a needed system in economic and technological terms. Have students prepare a Request for Quote.

References:

(1) DOD Directive 4105.62 (Series), "Source Selection Procedures."

(2) All references listed for Proposal Evaluation.

(3) Department of the Navy, Source Selection Plan for Fast Deployment Logistics Ship Project, May, 1967.

(4) Department of Defense, Armed Service Procurement Regulation, Washington, D. C., Government Printing Office, June 30, 1969.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Proposal Evaluation

Description:

	Topic	Estimated Hours of Instruction
1.	Purpose and need for objective proposal evaluation criteria	1
2.	Development of technical evaluation criteria	2
3.	Use of contractor performance data in proposal evaluation	4
4.	Use of contractor accounting records as a data source for cost analysis of proposals	4
5.	Weapons Systems Acquisition Manager's alternatives in recommending award after evaluation	1
6.	Contractual value of proposal evaluation criteria	2

Recommended Format:

(1) Material should be presented by class lecture. Selected readings should be used as support material. Upon completing Topic 4, a prepared case should be given the students from which they would prepare proposal evaluation criteria.

References:

(1) The RAND Corporation, Report P-411S, Contractor Accounting Records as a Data Source for Cost Analysis.

(2) Office of the Secretary of Defense, Guide to Contractor Performance Evaluation, Washington, D. C. , U. S. Government Printing Office, June 1966.

(3) Report to the President on Government Contracting for Research and Development, 30 April 1962, U. S. Government Printing Office, 11 May 1962, Document No. 94, 87th Congress, 2nd Session.

(4) Pace, D. F., Negotiation and Management of Defense Contracts, New York, Wiley-Interscience, 1970.

(5) Naval Material Command, Defense Procurement Management for Technical Personnel, Boston, Harbridge House, Inc., 1970.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Make or Buy Decisions

Description:

Topic	Estimated Hours of Instruction
1. Legal barriers to free choice in Make or Buy decisions	1
2. Determination of component level of essentiality	2
3. Determination of vendor ranking criteria	4
4. Elements of full economic cost	1
5. Evaluation of in-house capacity versus vendor capacity	1
6. Purchase order review and evaluation techniques	1

Recommended Format:

(1) Present topics through class lecture and selected readings. Require students to develop a vendor ranking system of either a heuristic or statistical nature after completion of lectures on Topic 5.

References:

(1) Johnson, R. E. and Hall, G. R., Public Policy Toward Subcontracting, Santa Monica, California, The RAND Corporation, Memorandum RM-4570-PR, May 1965.

(2) Department of Defense, Armed Services Procurement Regulations, Washington, D. C., Government Printing Office, June 20, 1969, Chapter 3 and Appendix K.

(3) Military Specification, MIL-I-45208A, "Inspection System Requirements."

(4) Military Specification, MIL-Q-9859, "Quality Assurance Requirements."

(5) DOD Instruction 7700.12 (Series), "Reporting Unsatisfactory Newly Procured and Contractor Maintained Material."

(6) Ammer, D. A., Materials Management, Homewood, Illinois, Richard D. Irvin, Inc., 1968.

(7) Walworth, R. B., "Relationship Between Procurement and Quality Control," Industrial Quality Control, Vol XVIII, No. 1, July 1961.

(8) Larson, J. A., "Improving Supplier Performance," Industrial Quality Control, Vol. XIX, No. 10, April 1963.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Contract Negotiation Processes

Description:

Topic	Estimated Hours of Instruction
1. Contract types	1
2. Selecting the proper contract type	1
3. Clearing the contract	1
4. Negotiating techniques	4
5. Consideration of basic managerial and technical data needs by cost/ benefit analysis	1
6. Communications with prospective contractors	2
7. Making award of a contract	1

Recommended Format:

(1) Present topics 1, 2, 3 and 7 through class lectures.

(2) Present topics 4 and 6 through case studies, employing role playing techniques with students acting as both principals and critics. The instructor acting as arbitrator. Topic 5 should be presented through a problem case that requires students to make a written presentation of basic data needs.

References:

(1) McKechnie, J. J., Truth in Negotiations, Thesis, George Washington University, September, 1969.

(2) Donzell, R. J., Negotiation Technique in Price Determination, Thesis, George Washington University, June, 1969.

(3) Fisher, J. N., A Reappraisal of Incentive Contracting Experience, Santa Monica, California, The RAND Corporation, Reprot #RM-5700-PR, July, 1968.

(4) Hall, G. R. and Johnson, R. E., Competition in the Procurement of Military Hard Goods, Santa Monica, California, The RAND Corporation, Report #P-3796-1, June, 1968.

(5) Croke, P. V., Lessons Learned From Contract Definition, Boston, Peat Marwick Management Systems Co., August, 1965.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Elements of Configuration Management

Description:

Topic	Estimated Hours of Instruction
1. Types of contractual changes	1
2. Elements of trade-off decisions	2
3. Elements of feasibility analysis	2
4. Elements of value engineering	2
5. Techniques of contract change costing	4

Recommended Format:

(1) Topics 1 through 4 should be presented through class lectures and case studies.

(2) Topic 5 should be presented via lecture, readings, and problem solving. Special attention should be given to the development of skill in utilizing regression analysis as a means of producing estimates from historical performance data.

References:

(1) Gallagher, P. F. , Project Estimating by Engineering Methods, New York, Hayden Book Co., Inc., 1965.

(2) Masse, Pierre, Optimal Investment Decisions: Rule for Action and Criteria for Choice, Englewood Cliffs, New Jersey, Prentice-Hall, 1962.

(3) Department of Defense, Armed Services Procurement Regulation, Washington, D. C., Government Printing Office, June 30, 1969.

(4) Naval Ship Systems Command, Value Engineering Conference, Cambridge, Massachusetts, Harbridge House, Inc., December, 1966.

(5) vom Bauer, F. F., "Constructive Change Orders — Basic Principles and Guidelines," The Government Contractor, October, 1965.

(6) Logistics Management Institute, Task 67-16, Defense Industry Value Engineering Program Review, February, 1968.

COURSE SPECIFICATION SHEET

TITLE: NON-NUMERICAL INFORMATION PROCESSING (CS 4310)

Course Description:

Elements	Estimated Hours of Instruction
1. Definition of Heuristic versus Algorithmic methods	1
2. Rationale of Heuristic Approach	2
3. Description of cognitive processes	2
4. Approaches to mathematical invention	10
5. Simulation of cognitive behavior and self-organizing systems	10
6. Heuristic programming techniques	15

Prerequisites:

(1) CS 2110, Introduction to Computer Processes

(2) CS 3111, Programming Languages

Recommended Course Format:

(1) All topics should be covered by class lectures.

(2) Elements 4, 5, and 6 should be highly supplemented by case study problems with maximum utilization of the school's computer.

References:

(1) The basic text recommended for this course is Critical Thinking — An Introduction to Logic and Scientific Method by Max Black. Text material specific to computer application of Heuristic methods should be drawn from current computer-oriented periodicals.

Terminal Behavior Objectives:

(1) The student should be able to list and define the elements of a deductive argument.

(2) The student should be able to list and define the formal properties of implication.

(3) The student should be able to construct truth tables.

(4) The student should be able to conduct subject-predicate analysis of propositions.

(5) The student should be able to determine the validity of syllogisms by Venn diagrams.

(6) The student should be able to demonstrate the proper use of the rules of definition.

(7) The student should be able to construct heuristic models.

COURSE SPECIFICATION SHEET

TITLE: DEFENSE REQUIREMENTS ANALYSIS (PM 4411)

Course Description:

Elements	Estimated Hours of Instruction
1. The predictability of time, quality, and costs in weapons programs	10
2. Internal uncertainties and the technological character of weapons acquisition	10
3. External uncertainties in weapons acquisiton	8
4. Risk, lead time, and project cost	16

Prerequisites:

PS 3302, PS 3303

Recommended Course Format:

(1) Introduce topics by class lecture. Students work related problems taken, where possible, from existing programs.

References:

(1) Peck, M. J. and Scherer, F. M., The Weapons Acquisition Process, Boston, Harvard University, 1962.

(2) Quade, E. W., (ed.), Analysis for Military Decisions, Santa Monica, California, The RAND Corporation, 1964.

(3) Snyder, W. P., Case Studies in Military Systems Analysis, Washington, Industrial College of the Armed Forces, 1967.

COURSE SPECIFICATION SHEET

TITLE: CORPORATE STRATEGY (PM 4421)

Course Description:

Elements	Estimated Hours of Instruction
1. Identifying Symptoms and Defining Issues	9
2. Diagnosing Problems and Opportunities	7
3. Defining Basic Objectives	7
4. Developing Plans and Strategies	7
5. Structuring and Controlling Plans of Action	7
6. Appraising Plans and Strategies	7

Prerequisites:

PM 3300, PM 4400

Recommended Course Format:

(1) This course should be presented through assigned case studies and student presentations in class.

References:

(1) McNichols, T. J., Policy Making and Executive Action, New York, McGraw-Hill Book Co., 1967.

(2) Brown, R. E., Judgement in Administration, New York, McGraw-Hill Book Co., 1966.

(3) Jones, M. V., System Cost Analysis: A Management Tool for Decision Making, Bedford, Massachusetts, The Mitre Corporation, 30 July 1964.

COURSE SPECIFICATION SHEET

TITLE: AGENCY (PM 4431)

Course Description:

Elements	Estimated Hours of Instruction
1. Real Authority of an Agent	7
2. Apparent Authority of an Agent	7
3. Misrepresentations of an Agent	7
4. Ratification	7
5. Liability of an Unauthorized Agent	7
6. Authority of a Government Contract Administration Officer	9

Prerequisites: None

Recommended Course Format:

(1) The principle type of instruction should be student presentation of briefs of actual cases that have been heard before the U.S. Court of Appeals concerning military personnel as agents.

References:

(1) Mechem, F. R., Outlines of the Law of Agency, Chicago, Callaghan and Company, 1952.

(2) Department of Defense, Armed Services Procurement Regulation, Washington, D. C., Government Printing Office, June 20, 1969.

WEAPONS SYSTEMS ACQUISITION CURRICULUM — QUARTER V

(see Figure 12, page 42)

COURSE SPECIFICATION SHEET

TITLE: CONTRACT ADMINISTRATION (PM 4500)

Course Description:

Elements	Estimated Hours of Instruction
1. Elements of Performance Evaluation	8
2. Progress Payments	8
3. Elements of Production Scheduling and Control	13
4. Production Test Management	9
5. Elements of Claim Defense Documentation	8
6. D.C.A.S. and Government Source Inspection	5
7. Project Termination	5

Prerequisites:

PM 4400

Recommended Course Format:

(1) See individual course element specification sheets.

References:

(1) The primary text recommended for this course is Negotiation and Management of Defense Contracts by D. F. Pace, Wiley-Interscience, New York, 1970.

Terminal Behavior Objectives:

(1) Given raw production data in terms of man hours expended and productivity attained, the student must demonstrate ability to utilize regression analysis to project future productivity.

(2) Given a narrative case, the student must be able to define key milestones and establish a schedule network that identifies the critical path to project termination.

(3) Given raw data on resources available and a preliminary critical path network, the student must demonstrate an ability to accomplish resource leveling within prescribed tolerances.

(4) Given a narrative case with necessary cost figures on a test system, the student must be able to set up a logical cost-benefit analyis of the system. He must also be able to justify all trade-off decisions made as a result of this analysis.

(5) Given a general system simulation program capacity and necessary test system requirements and objectives, the student must demonstrate an ability to identify critical variables in the test system and successfully run a computer simulation of a given test.

(6) The student must be able to make a written definition of the known types and sources of Constructive Change Orders.

(7) The student must be able to define the nature of each element of a legal contract.

Input/Output Sequence in Quarter V:

(1) INPUTS. The educational inputs this quarter consist of a series of dummy or actual letters and contractually required reports of a prime contractor that was responsible for an existing Weapons System. These documents should be selected with strict reference to the course elements described above and should allow the student opportunity to demonstrate the required terminal behavior objectives previously prescribed. Every opportunity should be taken to re-exercise students in all course element skills acquired in previous quarters.

(2) OUTPUTS. The outputs of the students this quarter will be formal letter replies to the input letters and reports of this quarter. These letters shall be prepared from the viewpoint of a Contract Administration Officer replying to his contractor.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Performance Evaluation

Description:

	Topic	Estimated Hours of Instruction
1.	Review of "Elements of Proposal Evaluation" from PM 4400	3
2.	Records necessary for adequate performance evaluation	1
3.	Elements of the Management Audit	2
4.	Development of Evaluation Standards	1
5.	Reporting Findings of Fact	1

Recommended Format:

(1) Topics 1 and 3 should be presented by class lecture.

(2) Topics 2, 4, and 5 should be presented through readings of actual DOD evaluation files and student team critiques of these readings.

References:

(1) Office of the Secretary of Defense, Guide to Contractor Performance Evaluation, Washington, D. C., Government Printing Office, June, 1966.

(2) Rose, T. G., The Management Audit, London, GEE, 1961.

(3) Department of Defense, Armed Services Procurement Regulation, Washington, D. C., Government Printing Office, June 30, 1969.

(4) Burington, R. S., Concerning Principles Underlying the Construction of Evaluation Criteria and Scoring Systems for Use in Source Selection, Report R-14-36, Bureau of Naval Weapons, Washington, D. C., November, 1965.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Progress Payments

Description:

Topic	Estimated Hours of Instruction
1. The nature and purposes of progress payments	1
2. Statistical sampling of work progress to determine accuracy of physical progress claimed by a prime contractor	2
3. Settling disputes concerned with progress payments	1
4. Progress payments and non-conforming supplies and services	1
5. Impact of changes to contract on progress payments	1
6. Establishing cost account weights for progress payments	2

Recommended Format:

(1) Present all topics through class lecture. Divide class into opposing teams of four each for last two hours of Topic 6 and have them negotiate a set of weighting factors for an actual case concerning an existing weapon system.

References:

(1) Department of Defense, Armed Services Procurement Regulation, Washington, D. C., Government Printing Office, June 30, 1969.

(2) Naval Ship Systems Command, Ship Acquisition and Conversion Manual (SACAM),

COURSE ELEMENT SPECIFICATION SHEET

Element:

Elements of Production Scheduling and Control

Description:

Topic	Estimated Hours of Instruction
1. Types and applications of Scheduling and Control Techniques	1
2. Identification and definition of objective schedule milestones	2
3. Event-oriented network	1
4. Implementing a PERT or CPM system	1
5. Allocation of Multiple Resources	3
6. Resource leveling	4
7. Probability in Scheduling	2
8. Management and control	1
9. Computer applications appropriate for production scheduling and control	1

Recommended Format:

(1) All topics should be covered initially with class lectures and selected readings.

(2) Topics 2, 5, 6, and 7 should have additional coverage through the assignment of work practice problems to the students. Particular emphasis should be given to topics 5 and 6 in order to provide the student with practical working knowledge of resource allocation problems.

References:

(1) Army Logistics Management Center, Fundamentals of Specifications, Report USALMC -3T-38-50A, Fort Lee, Virginia, 1967.

(2) Department of Defense, PERT Cost Systems Design, DOD and NASA Guide, June, 1962.

(3) Bostock, D. J., Tabular Line-of-Balance Production Control Techniques, Union Carbide Corporation, Report Y-KA-17, August 11, 1966.

(4) Horowitz, Joseph, Critical Path Scheduling, New York, Ronald Press Co., 1967.

(5) Martino, R. L., Project Management and Control, Volume II, Applied Operational Planning, New York, American Management Association, 1964.

(6) Martino, R. L., Project Management and Control, Volume III, Allocating and Scheduling Resources, New York, American Management Association, 1964.

(7) Horaclk, J. L., A Computer Approach to Resource Allocation Within the Framework of C.P.M. Scheduling, Thesis, Massachusetis Institute of Technology, January, 1965.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Production Test Management

Description:

	Topic	Estimated Hours of Instruction
1.	Elements of test systems design	3
2.	Cost-benefit analysis of test systems	2
3.	Test simulation	2
4.	Evaluation of test results	2

Recommended Format:

(1) All topics should be covered by class lectures and student problem-solving exercises based on case studies.

References:

(1) Kline, M. B. and Lifson, M. W., Design: The Essence of Engineering, Los Angeles, University of California, April, 1968.

(2) Office of the Assistant Secretary of Defense (Installation and Logistics), Procurement Quality Assurance, Handbook H-57, Washington, D. C., Government Printing Office, June, 1969.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Elements of Claim Defense Documentation

Description:

	Topic	Estimated Hours of Instruction
1.	Nature of Constructive Change Orders	1
2.	Nature of Agency	1
3.	Types of Constructive Change Orders	3
4.	Sources of Constructive Change Orders	1
5.	Communications with Contractor Personnel	1
6.	Documentation of Adverse Findings Against a Contractor	1

Recommended Format:

(1) All topics should be presented by lecture and selected readings from Armed Services Board of Contract Appeals cases.

References:

(1) Burham, Frank, "The Pentagon and Industry: Antagonism Replacing Trust," Armed Forces Management, January, 1970.

(2) Mechem, F. R., Outlines of the Law of Agency, Chicago, Callaghan and Company, 1952.

(3) SECNAVINST 4200.23, "Correspondence and Oral Communications with Contractors Concerning Navy Contractual Matters."

(4) Vom Bauer, F. T., "Constructive Change Orders — Basic Principles and Guidelines," The Government Contractor, October, 1965.

(5) The Government Contractor, Washington, D. C., Federal Publications, Inc. (Published bi-weekly).

COURSE ELEMENT SPECIFICATION SHEET

Element:

Defense Contract Administration Service and Government Source Inspection

Description:

	Topic	Estimated Hours of Instruction
1.	Purpose of D.C.A.S.	1
2.	Purpose of G.S.I.	1
3.	Defining product level of essentiality	1
4.	Evaluating D.C.A.S. inspection reports	1
5.	Use of contractor performance evaluation files for G.S.I determination	1

Recommended Format:

(1) All topics should be covered by class lecture.

References:

(1) Military Specification MIL-Q-9858, "Quality Assurance Requirements."

(2) Office of the Assistant Secretary of Defense (Installations and Logistics), Procurement Quality Assurance Handbook H-57, Washington, D. C., Government Printing Office, June, 1969.

COURSE ELEMENT SPECIFICATION SHEET

Element:

Project Termination

Description:

	Topic	Estimated Hours of Instruction
1.	Nature of Contract Breach and Default	1
2.	Nature of Contract Termination for Convenience of the Government	1
3.	Nature of Product Guaranty Provisions	1
4.	Elements of Product Final Acceptance	1
5.	Documentation for Project Termination	1

Recommended Format:

(1) All topics should be covered by class lecture.

References:

(1) AFR 375-4, "System Program Documentation," March 6, 1960.

(2) Cleland, D. K. and King, W. R., Systems Analysis and Project Management, New York, McGraw-Hill Book Company, 1968.

(3) Perry, R. L. and others, System Acquisition Experience, Santa Monica, California, The RAND Corporation, Memorandum RM-6072-PR, November, 1969.

COURSE SPECIFICATION SHEET

TITLE: MANAGEMENT OF RESEARCH AND DEVELOPMENT (PM 4511)

Course Description:

Elements	Estimated Hours of Instruction
1. R&D estimating, costing, and budgeting	16
2. R&D Personnel	4
3. Control of R & D	12
4. Appraisal of the RDT&E effort	12

Prerequisites:

PM 3300, PM 4400

Recommended Course Format:

(1) Class lecture and presentation

References:

(1) Roman, D. D., Research and Development Management, New York, Appleton-Century-Crofts, 1968.

(2) Jones, M. V., Systems Cost Analysis: A Management Tool For Decision Making, Bedford, Massachusetts, The Mitre Corporation, TM 04063/0000/00/0/00, July, 1964.

(3) Assistant Secretary of the Navy (R&D), NAVSD P-2457(Rev 7-69), Department of the Navy RDT&E Management Guide, Washington, D. C., July, 1969.

COURSE SPECIFICATION SHEET

TITLE: INTRODUCTION TO LOGISTICS AND SUPPLY SYSTEMS (PM 4521)

Course Description:

Elements	Estimated Hours of Instruction
1. Planning Logistics Support	11
2. Integrated Logistics System Models	11
3. Techniques of Integrated Logistics	11
4. Controlling Integrated Logistics Support Systems	11

Prerequisites:

PM 3300, PM 4400

Recommended Course Format:

(1) Emphasis should be placed on outside readings and seminar type discussions. A term research paper on a student selected topic relating to logistics systems should be required.

References:

(1) Planning Research Corporation, Navy Rapid Delivery Logistics, Vol. I-III, 31 May 1968.

(2) Logistics Management Institute, DOD Systems and Equipment, Integrated Logistics Support Planning Guide, December, 1967.

(3) Fisher, R. R. and others, The Logistics Composite Model: An Overall View, Palo Alto, California, The RAND Corporation, RM-5544-PR, May, 1968.

(4) Haber, S. E., Simulation of a Multi-Echelon Support System, George Washington University, Serial T-192, 16 June 1967.

COURSE SPECIFICATION SHEET

TITLE: CONTRACT DISPUTES (PM 4531)

Course Description:

Elements	Estimated Hours of Instruction
1. Nature and Sources of Constructive Change Orders	7
2. Nature of Contract Disputes and Claims	7
3. Nature of Armed Services Board of Contract Appeals (ASBCA)	7
4. Claim Documentation	7
5. Governments Rights under the Changes, Disputes and Termination Clauses of a Government Contract	8
6. Contractor's Rights under the Changes, Disputes and Termination Clauses of a Government Contract	8

Prerequisites: None

Recommended Course Format:

(1) The means of instruction should consist of student case briefings of ASBCA cases.

References:

(1) Department of Defense, Armed Services Procurement Regulation, Washington, D. C., Government Printing Office, June 30, 1969.

(2) Selected ABSCA cases.

APPENDIX B

EXAMINATION OF STUDENT INPUT CONSTRAINT

One constraint placed on this study was that input candidates should possess an undergraduate engineering degree. Another constraint stated that these candidates must have demonstrated above-average grade trends in mathematics, including Differential and Integral Calculus. It is assumed that these constraints were intended to insure that future project managers would be able to "speak the language" of the various weapons systems technologists with whom they would come in contact.

It was felt that this approach disregarded an alternative — inputs that offered a higher probability of producing high-quality project managers. This Appendix documents this alternative.

First of all, the bulk of published research shows a relatively low relationship between academic success and on-the-job success.*

Second, project management skills are more related to stochastic and heuristic problem-solving than to precise mathematical solutions. Engineers are generally oriented to the mathematical problem-solving approach.

Third, the best key the Navy has to an officer's performance capability lies in his fitness reports.

Fourth, dislikes are more important than likes in defining patterns of interest. A person whose interest patterns show distinct dislike for

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*Githens, W. H. and others, Source Warfare Specialty, and Tenure of High Quality General Line Officers, U. S. Naval Personnel Research Activity, San Diego, California, Research Report SRR68-22, p. 2.

several of the following fields of endeavor would probably be poorly motivated as a project manager:

1. Financial Management
2. Personnel Administration
3. Engineering Sciences
4. Law
5. Industrial Production*

Fifth, it would not take any longer to produce an undergraduate engineer from a person holding a Master of Science degree in Operations Analysis, Mathematics, Economics or Business Administration than the reverse process of changing an undergraduate engineer into a graduate in Management Science.

Inputs from all four groups would provide a broader and deeper talent pool.

The following table illustrates this point:

Courses contained in USNPS Mechanical Engineering (B.S.M.E.) Common to Management, Mathematics, and Operations Analysis Masters Programs at USNPS	Quarter Hours
Calculus Review	4
Introduction to Linear Algebra	3
Differential Equations and Infinite Series	4
Systems Analysis	4
Resource Management for Defense	4
Fundamentals of Operations Analysis	4
Total	23 hours or 1+ term work

*The U. S. Naval Personnel Research Activity, San Diego, California, can provide much documentation and information on Naval Officers scored by the "Strong Vocational Interest Blank." This test has been used with success in screening candidates for the NROTC programs.

Since the B.S.M.E. curriculum is seven terms, and the average master's program graduate could validate one term's work, the program could be completed in the same time frame as is currently planned for undergraduate engineers to finish the M. S. in Project Management.

Considering the viewpoint discussed above, the following recommendations are Made.

1. Use a combination of the Fitness Report Summary Record, the Officer Classification Battery and the Strong Vocational Interest Blank scores as criteria for selection of candidates for the proposed program.

2. Fit the curriculum to the individual that shows promise through the results displayed by the Fitness Report Summary Record and the Strong Vocational Interest Blank scores. In other words strengthen or create skills where necessary to raise the individuals ability to the same level as his interest.

3. Reconfigure the current NPS Management Curriculum along the lines of the program outlined in this paper.

BIBLIOGRAPHY

BOOKS

1. Ammer, D. A., Materials Management, Homerwood, Illinois, Richard D. Irvin, Inc., 1968.

2. Baumol, W. J., Economic Theory and Operations Analysis, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1965.

3. Black, Max, Critical Thinking, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1952.

4. Black's Law Dictionary, Rev. 4th Edition, West Publishing Co., 1968.

5. Blatt, E. M., Introduction to Fortran IV Programming, Pacific Palisades, California, Goodyear Publishing Co., 1968.

6. Brown, F. R. (ed.), Management: Concepts and Practices, Washington, Industrial College of the Armed Forces, 1967.

7. Brown, R. E., Judgement in Administration, New York, McGraw-Hill Book Co., 1966.

8. Buffa, E. S., Modern Production Management, New York, John Wiley & Sons, 1969.

9. Chestnut, Harold, Systems Engineering Tools, New York, John Wiley & Sons, Inc., 1965.

10. Churchman, C. W., Introduction to Operations Research, New York, John Wiley & Sons, 1964.

11. Cleland, D. and King, W. R., Systems Analysis and Project Management, New York, McGraw-Hill Book Company, 1968.

12. Corrigan, R. E., Why Systems Engineering? Palo Alto, California, Fearon Publishers, 1966.

13. Cronbach, L. J. and Gleser, G. C., Psychological Tests and Personnel Decisions, Urbana, Illinois, University of Illinois Press, 1965.

14. Dommasch, D. O. and Laudeman, C. W., Principles Underlying Systems Engineering, New York, Pitman Publishing Corporation, 1962.

15. Dunnette, M. D., Personnel Selection and Placement, Belmont, California, Wadsworth Publishing Co., Inc., 1966.

16. Emery, J. C., Modern Approaches to Production Planning and Control, New York, American Management Association, Inc., 1960.

17. Forsythe, A. I., and others, Computer Science: A First Course, New York, John Wiley and Sons, Inc., 1969.

18. Gallagher, P. F., Project Estimating By Engineering Methods, New York, Hayden Book Co., Inc., 1965.

19. Gregory, R. H. and Van Horn, R. L., Automatic Data Processing Systems, Belmont, California, Wadsworth Publishing Co., Inc., 1968.

20. Groscoe, E. S., Project Economy, Homewood, Illinois, Richard D. Irwin, Inc., 1960.

21. Guion, R. M., Personnel Testing, New York, McGraw-Hill, Inc., 1965.

22. Higman, Bryan, Comparative Study of Programming Languages, New York, American Elsevier Publishing Co., Inc., 1967.

23. Hillier, F. S. and Lieberman, G. J., Introduction to Operations Research, San Francisco, Holden-Day, Inc., 1967.

24. Hitch, C. J. and McKean, R. N., Elements of Defense Economics, Washington, Industrial College of the Armed Forces, 1967.

25. Horngren, C. T., Accounting for Financial Control, Englewood Cliffs, New Jersey, Prentice-Hall, 1965.

26. Horowitz, Joseph, Critical Path Scheduling, New York, Ronald Press Co., 1967.

27. Johnson, R. A. and others, The Theory and Managment of Systems, New York, McGraw-Hill Book Company, 1963.

28. Karger, D. W. and Murdick, R. G., Managing Engineering and Research, New York, The Industrial Press, 1963.

29. Kline, M. B. and LIfson, M. W., Design: The Essence of Engineering, Los Angeles, University of California, April, 1968.

30. Koontz, H. and O'Donnell, C., Principles of Management, New York, McGraw-Hill Book Co., 1964.

31. Lifson, M. W., The Application of the Methodology of Design to the Design of a Course in Engineering Economics, Los Angeles, University of California, October, 1963.

32. Likert, P., New Patterns of Management, New York, Holt & Co., 1961.

33. Mager, R. F., Preparing Instructional Objectives, Palo Alto, California, Fearon Publishers, Inc., 1962.

34. Margulis, N. J. and Yoshpe, H. B., Procurement, Washington, Industrial College of the Armed Forces, 1964.

35. Martino, R. L., Critical Path Networks, Wayne, Pennsylvania, MDI Publications, 1967.

36. Martino, R. L., Project Management and Control — Volume II — Applied Operational Planning, New York, American Management Association, 1964.

37. Martino, R. L., Project Management and Control — Volume III — Allocating and Scheduling Resources, New York, American Management Association, 1965.

38. Masse, Pierre, Optimal Investment Decisions: Rule for Action and Criteria for Choice, Englewood Cliffs, New Jersey, Prentice-Hall, 1962.

39. McNichols, T. J., Policy Making and Executive Action, New York, McGraw-Hill Book Co., 1967.

40. Mecham, F. R., Outlines of the Law of Agency, Chicago, Callaghan and Company, 1952.

41. Pace, D. F., Negotiation and Management of Defense Contracts, New York, Wiley-Interscience, 1970.

42. Peck, M. J. and Scherer, F. M., The Weapons Acquisition Process, Boston, Harvard University, 1962.

43. Quade, E. S., Analysis for Military Decisions, Santa Monica, RAND Corporation, 1964 (RAND Number R-387-PR).

44. Rapoport, Anatole, Strategy and Conscience, New York, Schocken, 1967.

45. Roman, D. D., Research and Development Management, New York, Appleton-Century-Crofts, 1968.

46. Rose, T. G., The Management Audit, 3rd ed., London, GEE, 1961.

47. Schoderbek, R. P., Management Systems, New York, John Wiley and Sons, Inc., 1967.

48. Shuckman, A., Scientific Decision Making In Business, New York, Holt, Rinehart & Winston, 1963.

49. Sisk, H. L., Principles of Management, Cincinnati, South-Western Publishing Co., 1969.

50. Snodgrass, R. J., The Concept of Project Management, Washington, D. C., Historical Office, U. S. Army Material Command, 1964.

51. Snyder, W. P., Case Studies in Military Systems Analysis, Washington, Industrial College of the Armed Forces, 1967.

52. Spiller, E. A., Financial Accounting, Homewood, Illinois, Irwin, Inc., 1966.

53. Steiner, G. A. and Ryan, W. G., Managerial Methods of Successful Project Managers With a Loose Rein, Los Angeles, University of California at Los Angeles, 1965.

54. Thorndike, R. L., Personnel Selection, New York, Wiley and Sons, 1949.

55. Thuesen, H. G. and Fabrycky, W. J., Engineering Economy, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1964.

56. Woolley, E. C., New Handbook of Composition, Boston, D. C. Heath & Co., 1926.

57. Yoshpe, H. G. (ed.), Requirements: Matching Needs With Resources, Washington, Industrial College of the Armed Forces, 1964.

58. Yoshpe, H. G. (ed.), Production: The Industrial Sector in Peace and War, Washington, Industrial College of the Armed Forces, 1966.

59. Yoshpe, H. G. and Bauer, T. W., Defense Organization and Management, Washington, Industrial College of the Armed Forces, 1967.

60. Zehna, P. W., Probability Distributions and Statistics, Boston, Allyn and Bacon, Inc., 1970.

HANDBOOKS AND GUIDES

61. Assistant Secretary of the Navy (R & D), NAVSO P-2457(Rev 7-69), Department of the Navy RDT&E Management Guide, Washington, D. C., 1969.

62. Bureau of Naval Personnel (NAVPERS 10792-B(INT)), Financial Management in the Navy, Washington, D. C., December, 1966.

63. Chief of Naval Material, Defense Procurement Handbook, NAVMAT P-12400.

64. Chief of Naval Material, Guide for the Preparation of Proposed Technical Approaches (PTA), Washington, D. C., February, 1966.

65. Chief of Naval Material, Guide for the Preparation of Technical Development Plans, Washington, D. C., July, 1965.

66. Defense Weapon Systems Management Center, Student Study Guide, Wright Patterson Air Force Base, Ohio, nd.

67. DOD Handbook H472, Maintainability Prediction, 24 May 1966.

68. Department of the Navy, Office of the Comptroller, Publication NAVSO P-3047, Resource Manager's Guide, June, 1968.

69. Engineering and Physical Sciences Extension, University Extension, University of California at Los Angeles, Systems Engineering Management, 1970.

70. Litton Industries, Position Guide For Engineering Project Managers, nd.

71. Naval Material Command, Defense Procurement Management For Technical Personnel, Boston, Harbridge House, Inc., 1970.

72. Naval Ship Systems Command, Field Contract Administration Course, Boston, Harbridge House, Inc., 1968.

73. Naval Ship Systems Command, Ship Acquisition and Conversion Manual (SACAM).

74. Office of the Assistant Secretary of Defense (Installations and Logistics), Procurement Quality Assurance, Handbook N-57, Washington, D. C., Government Printing Office, June, 1969.

75. Office of the Assistant Secretary of Defense (Installations and Logistics), Technical Report TR-7, Factors and Procedures for Applying MIL-STD. 105D Sampling Plans to Life and Reliability Testing, 21 May 1965.

76. Office of the Secretary of Defense, Guide to Contractor Performance Evaluation, Washington, D. C., U. S. Government Printing Office, June, 1966.

77. Stanford University, Algol W Language Description, Palo Alto, California, 1969.

78. U. S. Naval Postgraduate School, Catalogue for 1970-1972, Monterey, California, 1970.

REPORTS AND THESES

78. Army Logistics Management Center, Fundamentals of Specification, Report USALMC-3T-38-50A, Fort Lee, Virginia, 1967.

79. Bain, J., Introduction to Systems Planning, Wright-Patterson AFB, Ohio, Ohio State University Research Foundation, 1969.

80. Bean, E. E. and Steger, W. A., Quality Control and Reliability for a Total Weapon System, Santa Monica, California, The RAND Corporation, Memorandum RM-3130-PR, August,1962.

81. Bostock, D. J., Tabular Line-Of-Balance Production Control Techniques, Union Carbide Corporation, Report Y-KA-17, August 11, 1966.

82. Brandenburg, R. G. and Stedry, A., Planning and Budgeting in a Multiphase R & D Process, Pittsburgh, Carnegie Institute of Technology, November, 1966.

83. Burington, R. S., Concerning Principles Underlying the Construction of Evaluation Criteria and Scoring Systems for Use In Source Selection, Report R-14-36, Bureau of Naval Weapons, Washington, D. C., November, 1965.

84. Commander Naval Ship Systems Command, NAVSHIPS Course and Speed, Second Quarterly Report, April, 1970.

85. Croke, P. V., Lessons Learned From Contract Definition, Boston, Peat Marwick Management Systems Co., August, 1965.

86. Department of Defense, PERT Cost Systems Design, DOD and NASA Guide, June, 1962.

87. Department of the Navy, Source Selection Plan For Fast Deployment Logistics Ship Project, May, 1967.

88. Donzell, R. J., Negotiation Technique In Price Determination, Thesis, George Washington University, June, 1969.

89. Fisher, J. N., A Reappraisal of Incentive Contracting Experience, Santa Monica, California, The RAND Corporation, Report #RM-5700-PR, July, 1968.

90. Fisher, R. R. and others, The Logistics Composite Model: An Overall View, Palo Alto, California, The RAND Corporation, RM-5544-PR, November, 1968.

91. Githens, W. H. and others, Source Warfare Specialty, and Tenure Of High Quality General Line Officers, U. S. Naval Personnel Research Activity, San Diego, California, Research Report SRR68-22.

92. Haber, S. E., Simulation of a Multi-Echelon Support System, George Washington University, Serial T-192, 16 June 1967.

93. Hall, G. R. and Johnson, R. E., Competition in the Procurement of Military Hard Goods, Santa Monica, California, The RAND Corporation, Report #P-3796-1, June, 1968.

94. Hill, L. S., Management Planning and Control of Research and Technology Projects, Santa Monica, California, The RAND Corporation, Memorandum RM-4921-PR, June, 1966.

95. Horaclk, J. L., A Computer Approach to Resource Allocation Within the Framework of C.P.M. Scheduling, Thesis, Massachusetts Institute of Technology, January, 1965.

96. Johnson, R. E. and Hall, G. R., Public Policy Toward Subcontracting, Santa Monica, California, The RAND Corporation, Memorandum RM-4570-PR, May, 1965.

97. Jones, M. V., Systems Cost Analysis: A Management Tool for Decision Making, Bedford, Massachusetts, The Mitre Corporation, TM/04063/0000/00/0/00, July, 1964.

98. Kline, M. B. and Lifson, M. W.,"Systems Engineering Management" (lecture notes), U.C.L.A., 1970.

99. Logistics Management Institute, DOD Systems and Equipment, Integrated Logistics Support Planning Guide, December, 1967.

100. Logistics Management Institute, Task 67-16, Defense Industry Value Engineering Program Review, February, 1968.

101. McKechnie, J. J., Truth in Negotiations, Thesis, George Washington University, September, 1969.

102. Naval Ship Systems Command, Value Engineering Conference, Cambridge, Massachusetts, Harbridge House, Inc., December, 1966.

103. Novick, D., Program Budgeting in the Department of Defense, Santa Monica, California, The RAND Corporation, Memorandum RM-4210-RC, September, 1964.

104. Peat, Marwick, Livingston & Company, A Report on Contract Definition, Boston, January, 1967.

105. Perry, R. L. and others, System Acquisition Experience, Santa Monica , California, The RAND Corporation, Memorandum RM-6072-PR, November, 1969.

106. Planning Research Corporation, NAVY Rapid Delivery Logistics, Vol. I-III, 31 May, 1968.

107. The RAND Corporation, Marshall, A. W. and Meckling, W. H., Predictability of the Costs, Time, and Success of Development, Santa Monica, California, October, 1959.

108. The RAND Corporation, Report P-4115, Contractor Accounting Records As a Data Source For Cost Analysis.

109. Report to the President on Government Contracting for Research and Development, 30 April 1962, U. S. Government Printing Office, 11 May, 1962, Document No. 94, 87th Congress, 2nd Session.

110. Waks, N., Close Collaboration in Contract Definition, Bedford, Massachusetts, The Mitre Corporation, June, 1967.

ARTICLES

111. Apple, R. E., "The Navy's Contract Definition Programs: A Review from Industry," Naval Engineers Journal, June 1970.

112. Avots, I., "Why Does Project Management Fail," California Management Review, Vol. XII, No. 1, Fall, 1969.

113. Baumback, C. M., "Inventory Control: How E.O.Q. Can Help," Management Review, April, 1962.

114. Brown, R. V., "Do Managers Find Decision Theory Useful," Harvard Business Review, Vol. 48, No. 3, May-June, 1970.

115. Burnam, Frank, "The Pentagon and Industry: Antagonism Replacing Trust," Armed Forces Management, January, 1970.

116. Churchman, C. W., "Operations Research As a Profession," Management Science-Application, Vol. 17, No. 2, October, 1970.

117. Cleland, D. I., "Project Management: An Innovation In Managerial Thought and Theory," Air University Review, Vol. XVI, No. 2, January-February, 1965.

118. Donovan, J. L., "The Importance of Objectives," Navy Training Bulletin, Fall, 1967.

119. Goodman, R. A., "Ambiguous Authority Definition In Project Management," Academy of Management Journal, Vol. 10, No. 4, December, 1967, p. 395.

120. The Government Contractor, Washington, D. C., Federal Publications Inc. (Published bi-weekly).

121. Laird, M. R., "Defense Budget Highlights, The Secretary's Summary," Defense Industry Bulletin, April, 1970.

122. Larson, J. A., "Improving Supplier Performance," Industrial Quality Control, Vol. XIX, No. 10, April, 1963.

123. Magee, J. F., "Decision Trees For Decision Making," Harvard Business Review, Vol. 42, No. 4, July-August, 1964.

124. Magee, J. F., "Guides To Inventory Policy," Harvard Business Review, Statistical Decision Series, Part I, n.d.

125. Pounds, W. F., "The Process of Problem Finding," Industrial Management Review, Vol. 11, No. 1, Fall, 1969.

126. Rossnagel, W. B., "If You Manage Engineers," Management Review, Vol. 58, No. 11, November, 1969.

127. Stewart, J. M., "Making Project Management Work," Business Horizons, Indiana University, Vol. 8, No. 3, Fall, 1965, pp. 54-68.

128. vom Bauer, F. F., "Constructive Change Orders — Basic Principles and Guidelines," The Government Contractor, October, 1965.

129. Walworth, R. B., "Relationship Between Procurement and Quality Control," Industrial Quality Control, Vol. XVIII, No. 1, July, 1961.

OFFICIAL DIRECTIVES AND SPECIFICATIONS

130. AFR 375-4, "System Program Documentation," March 6, 1960.

131. Armed Services Board of Contract Appeals Proceedings, Washington, D. C., Government Printing Office, Annual Series.

132. Chief of Naval Operations Letter OP-1020/jd, Ser 13118P10, Dtd. 11 August 1970.

133. Department of Defense, Armed Services Procurement Regulation, Washington, D. C., U. S. Government Printing Office, June 30, 1969.

134. DOD Directive 4105.62 (Series), "Source Selection Procedures."

135. DOD Instruction 7700.12 (Series), "Reporting Unsatisfactory Newly Procured and Contractor Maintained Material."

136. Military Specification, MIL-I-45208A, "Inspection System Requirements."

137. Military Specification, MIL-Q-9858, "Quality Assurance Requirements."

138. NAVMATINST 4200.31, "Advance Procurement Planning."

139. NAVMATINST 5000.5 (Series), "Project Management in the NMSE."

140. OPNAVINST 3900.6 (Series), "SOR and TSOR: Instructions For Preparation Of."

141. OPNAVINST 3910.7 (Series), "ADO: Procedures For Preparation Of."

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13. ABSTRACT

A study was performed to develop the curriculum that would utilize six academic quarters in the most effective manner to produce a graduate who could function effectively within the existing Department of Defense acquisition system and who could simultaneously assess and improve the system. The method followed was to develop a project manager model, then test the elements of existing applicable academic courses and selected military acquisition curricula against the model attributes in a Course Evaluation Matrix. Elements shown to be valuable were integrated into a product oriented curriculum consisting of a central core of project management courses and a series of basic academic discipline courses. The project management core interacts with a series of inputs simulating the life cycle of a typical project. Academic discipline courses are sequenced to be of immediate application in producing required output documentation. An Appendix provides a highly detailed description of the recommended curriculum.

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